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ENGINEERING.

In an address recently delivered before the Engineers' Club, in Philadelphia, Mr. Charles F. Scott made an able plea for closer cooperation between the various engineering societies.

This suggestion is worthy of careful consideration by all engineers. The day is past when petty jealousies should be allowed to interfere with the common interests of the profession. All members of these societies are primarily engineers. They are specialists in being mechanical or electrical engineers, as well as specialists in their own branches of engineering. Let us all work together for the common cause, for in this way far more can be accomplished than by single efforts.

Mr. Scott drew an attractive picture of a large engineering building in the metropolis, owned and used by all the engineering societies. Would not such a building prove the most practical means of bringing in closer touch all engineers? And since at this time several of these societies are without adequate homes, this would seem to be a good time to take some action in this matter.

The value of technical training is no longer questioned, and engineers are to-day often sought for the most important positions. This will undoubtedly be more frequently the case in the future; so let us all work together for the common cause and make the years to come the age of engineering.

WIRELESS TELEGRAPH PATENTS.

On another page of this issue will be found a brief digest of the series of very important patents in wireless telegraphy which have just been issued to Mr. John Stone Stone. These patents are very broad and cover the method and apparatus for a system of selected wireless telegraphy which, we are informed, has been put to very severe tests.

The system consists in producing at the transmitting station simple harmonic electromagnetic waves. The receiving station is tuned to receive waves of only one particular frequency. This is an evident solution of the problem of preventing interference between stations for which many inventors have been working.

Mr. Stone states that his experiments have shown conclusively that a difference of ten per cent in frequency in the waves received will determine completely whether or not they shall operate the receiver. These experiments were carried out in the neighborhood of two active trolley lines, but these in no way interfered with the operation of the stations.

The issue of these patents covering broadly a system of wireless telegraphy to an American inventor will doubtless be of much interest at this time when so much is being claimed for other systems.

THE TELEPHONE.

"What did you say his address was?" "Oh, I don't know; look in the telephone book." Such is the new order of things. Verily, we have become slaves of the telephone habit. We start from the ground and build a sky-scraper. Every floor is in telephonic communication with the offices of the supervising architect. We dig a hole in the ground and we tunnel a subway under the streets of the city, and at every step we carry a telephone outfit with us into the bowels of the earth. We go to the opera or we see a play, and we leave our card and seat number in the box office. Our barber has a telephone, for in this day we must annihilate distance and eliminate mischance of prompt communication. No matter where a man's place of business may be, we want to talk to him, and we want to talk to him at once. If he has no telephone we wire him and ask him to call us up that we may talk to him. We do not care to write, and if we can not see him personally, we talk to him by the medium of the telephone circuit. We can not bear to have any one separated from us by more than the breadth of the switch-hook. What was once the terror of nervous people has now become an absolute necessity to keep them in an orderly frame of mind. The boy going to school knows how to use the telephone as well as his father, and the matron seldom thinks of stepping to the store when she can do her ordering over the wire.

There is not a large building being erected to-day, but proper specifications are made out for the accommodation of telephone circuits. In office buildings a central exchange is a common feature, and the modern hotels and apartment houses are advertising their telephone service as an inducement to modern patronage. The business man, sitting in his office, is protected from the conversation of the bore and time-taking unneces-

sary calls by the angel who presides over the switchboard.

We have seen a mighty improvement in telephone service, and if we are to believe all that the manufacturers tell us we are yet to have better things. All this is timely and of especial interest anent the remarkable gathering in Chicago last week.

If there is any one thing which has been significant in this latest gathering of telephone men, it is the great change in sentiment which characterizes the attitude of the two factors in telephone operation. There was a time when the independent found the greatest relief in violently attacking the policies of the old-line company, and *vice versa,* the old-line company apparently taking a delight in predicting seasonable ruin and discomfiture for its ambitious offspring. However drastic have been the measures which these dominant principles of commercial development of telephony have hurled one against the other, they are both here to-day in a stronger position than ever. In spite of lower rates and promiscuous service on the part of early independents, the Bell company has now more subscribers than ever before, and the ratio of its gain in recent years is such as to occasion more than a passing remark. The independent exchange, on the other hand, lacking experience and, in many cases, badly managed, has thrived, and to-day there are under independent management some of the best equipped and best managed profit making exchanges. To-day the independent exchange is and ought to be a centre where can be expected the highest class of service. Profiting by the experience of men who have made telephony a life-long study, the apparatus which they may secure has been brought to a high grade. They have their choice of a score of manufacturers whose sole aim is to produce apparatus which shall be an improvement over everything which has gone before. Instead of indulging in a vicious criticism of policy, the independent exchange manager of to-day studies what new phase of service he can offer to his patrons which will form an inducement for them to talk over his lines. A more efficient piece of apparatus lets him give better service, and he immediately adapts his work to some new condition. No matter what the cost has been to either the old-line company or the independent, the public has received the benefit of their competition.

We are living next door to a decision in the Berliner patent case. The Carty bridging bell patents are in equity, and a decision is expected during the winter. The other case of importance to telephone interests is the Barrett patent, and we may expect soon to see a general clearing up of these cases and a truer realization of the real conditions of commercial telephony.

The independent telephone companies have made probably more substantial progress in the year just closing than for a considerable prior period. It is easy to remember the time when a dozen or so of small capitalists would get together, connect up eight or ten miles of wire on fence posts, operate probably a score of telephones, and call it an exchange. During the year just closing there has been a very great decrease in the number of exchanges established. At the same time, there has been a remarkable increase in the number of telephones connected up. This means that the larger cities are being invaded and the smaller plants are being brought in and merged with the larger corporations. While there has been considerable talk of the great development which has been going on in the Middle West, particularly in Ohio, Indiana and Iowa, there has been considerable done in points other than these. Pennsylvania has been booming along in fine style, the Philadelphia exchange being a model of its kind. Texas is being equipped with some of the longest independent lines that we know of, and, jumping clear to the Pacific coast, the Los Angeles exchange, which is about to be put in operation, is one of the most modern exchanges which has yet been equipped. Another large city where an independent exchange is almost ready for operation is Buffalo, N. Y.

A feature of decided importance, and which is to-day demanding more attention than ever before, is the automatic exchange. What we might term the "trial horse" companies at Fall River and New Bedford, Mass., are working right along, and, it is announced, are giving excellent service. A corporation is building an extensive system in Chicago, and here, it is claimed, automatic service will be given that will discount in every detail the completeness which we now secure from manual operation. Exchanges of this type have been ordered for Columbus and Dayton, Ohio, and leaving our own shores, distinct advances have been made for this class of service in Germany, and France is the most recent to take the matter up seriously.

The matter of a reduction in rates has received an almost complete quietus during the year. Several of the independent companies have flatly increased the rates which they established for their initial service, and, where it has been necessary, have requested their governing boards to allow them to so amend their charters that they might charge more for service given.

The improvement, then, which we may expect in telephony in the future will largely lie along the possibilities of automatic service and the increasing efficiency of switchboard practice. There is not much likelihood of the cost of operation becoming cheaper, although as the days go by the circuits are being made better and stronger, and the depreciation charges in this direction will necessarily become less.

In conclusion, with the betterment of apparatus and the eliminating of every objectionable feature as it appears, the length of circuit over which intelligible articulation can be produced is of the highest importance. The cable line being laid between Brussels and London affords an opportunity for learning a great deal about long-distance communication, and the most recent news of interest to the telephone world, to the effect that a large German corporation had acquired the use of the Pupin patents and intended making conclusive tests, holds out the happy thought that before long we may be able to talk as far as we can telegraph in a single relay.

THE UNDERWRITERS' ELECTRIC MEETING.

The progress of events has been exemplified during the last week by the meeting in New York on Tuesday and Wednesday, December 9 and 10, of the annual convention of the Underwriters' National Electric Association, which is the representative of the National Board of Fire Underwriters on matters pertaining to the relations of electricity to insurance.

As insurance is a representation of property interests, so the devotion of this branch of insurance to the subject of electricity indicates the importance of applied electricity as a financial proposition, and it also reveals the broad scope of underwriting at the present day.

The old time method of insurance was a clerical craft, charging all that the traffic would stand, as a means of guessing the risk; now it is a recognized profession, calling to its service the highest technical skill in measuring the risk and encouraging the assured to minimize the hazard.

In years agone, the rate was fixed like the laws of the Medes and Persians; now the recognition of the measures of protection and care enables the assured to fix his insurance premium, in great measure, by the amount which he is willing to expend for defence against fire, and this expenditure is proverbially a good investment.

This convention assembled without heralding, and after two days of assiduous labor adjourned without public chronicle, and while it would be unfeasible at this time for a journal to give a report in detail of its work, yet a résumé of the functions of this convention may pertain to the interests of our readers.

The purpose of these underwriters' electrical rules is a bold stroke, comprising as they do specifications bearing upon the construction, installation and operation of the whole range of commercial electrical apparatus.

There are indeed differences of degree in which these matters are considered, and it is explained that the cause of the apparent inconsistency is due to the relation which these details bear to the fire hazard, but there is enough specified in every branch to influence the greatest detail.

The impression which this convention first gave to a spectator was the desire to amend the rules in order that they should conform to the progress of commercial electricity; and, secondly, the concentration of observation and experience which the members furnished upon the points at issue. Clause after clause of existing rules was taken up and considered in the light of present conditions, and whether amendments were deemed necessary or not, the work proceeded in the light of the needs of existing conditions, free from any impediment of precedent.

This system of electrical rules began with a short circular twenty-one years ago, and they have grown, as have all other matters electrical, until they have expanded into a manual of nearly a hundred pages, and one of the alleged difficulties in these extensive rules has been the difference in the interpretation of the same clauses by different persons. These rules have great influence in shaping matters within their scope, and yet they are without professed executive authority. They represent a consensus of expert opinion, but this is followed by the rate-making authorities and compliance is rendered cheaper through the acts of this secondary source of power.

It is of great importance to individual manufacturers whether a clause shall make or break certain forms of subsidiary apparatus, and it is important that this power should be used in the most conservative manner. Without reciting the history of the numerous rules codified by various sources during the last twenty-one years, the present form is based upon the one prepared by the National Conference on Standard Electrical Rules, which was organized in New York—in March, 1896—by representatives of electrical manufacturing and operating interests and technical electrical organizations.

Their code was adopted by the Underwriters' National Electric Association, and the subsequent meetings of the latter body have been largely devoted to amendments to keep pace with the progress of the art, and it is therefore but natural that these meetings should be largely devoted to detail, and this phase of the work has increased to such an extent as to inspire the frequent query whether the function is not extending largely to detail rather than results, and to that extent affording grounds for the allegation that the original spirit of the code is becoming merged in this growth of detail.

This feature was brought to the attention of the convention in a forcible manner by the committee of the National Electrical Contractors' Association, which presented some criticisms upon the rules and the local differences of their enforcement, and their request for a board of appeal in cases of dispute between contractors and inspectors in the installation of electrical apparatus was granted by the convention.

As long as the underwriters' rules are equitably drawn with a view of establishing conditions of safety, and enforced in a uniform manner, they will continue to be an advantage to electrical interests, especially in providing standards of construction for installations.

The conditions of generators, motors and lamps are controlled by methods of manufacture which naturally standardize themselves according to the organization of various establishments, but the methods of installation and the subsidiary apparatus used for the control of the circuits require careful consideration to reduce to a system. In this work the underwriters have a large laboratory at Chicago where tests of electrical apparatus are made for the investigation of the merits of devices and methods.

The purpose of the whole movement of the underwriters' electrical rules is to improve standards, and in the measure that it is intelligently and equitably conducted so far should it be sustained by all electrical interests.

These rules have accomplished much in the past as a means by which the various improvements initiated by the electrical manufacturing industries have been endorsed and submitted to the patrons with the approval of a disinterested source.

In this manner may the work continue by which the standards shall be uplifted and everything possible done to increase the solidarity of electrical installations.

HIGH TEMPERATURE ELECTROCHEMISTRY—NOTES ON EXPERIMENTAL AND TECHNICAL ELECTRIC FURNACES.[1]

BY R. S. HUTTON AND J. E. PETAVEL.

Although a few pioneers like Siemens and Cowles foresaw the importance of the application of the electric furnace to chemical problems, it is only within the last ten years that most of the important processes have been developed. With the discovery of calcium carbide in 1892, the commercial possibilities of making use of the extreme temperature produced in the electric arc seem to have first forcibly impressed themselves both on the chemist and engineer, and the demands for power thus created brought into existence all over the world large generating plants, of which Niagara is a typical instance. In the early days Cowles found great difficulty in obtaining an electric plant of sufficient power for his purposes,[2] but soon the electrical engineer, realizing the nature of the demands made upon him, was fully able to cope with them. The provision of cheap power has in turn reacted in stimulating the development of many new chemical industries.

The magnitude of the present development of electric power for chemical purposes is clearly brought out in the statistics published by Swan.[3] The very small progress of electrochemistry here as compared with other countries is usually explained by invoking the well-worn excuse that comparatively little water power is available in Great Britain. This subject is worthy of much closer attention than has been given to it in the past. In the first place it is well to remember that in a great number of cases the cost of power is only a small percentage of the prime cost of the manufactured material. Again, the water power is frequently most inaccessibly situated, thus raising very considerably the cost in freight on raw material and finished product.[4] Owing to the improved efficiency of the steam engine, and to the huge progress made recently in the application of the gas engine to large powers, the cost of energy derived from coal is daily becoming less,[5] and is already capable of competing successfully with the less favorably situated water powers.

There is, indeed, no valid reason why many of the electrochemical industries should not be a success in this country. As will be seen later, a considerable number of electric furnace products are absorbed directly by the iron and steel industries, which themselves in this country are probably the most favorably situated for obtaining cheap power. The manufacture of the alloys of the rarer metals, either in direct connection with some existing steel works, or at any rate in these districts, should offer every economical advantage; moreover, in these cases the raw product forms a very large proportion of the total cost. Much has been written of the future which has been opened up by the application of producer and blast furnace gases,[1] but if we were to consecrate our whole time to the importance of this subject in its bearings on the electrochemical industry, we could hardly do it justice. We will, therefore, pass directly, first to the consideration of the subject in its experimental stage, and then follow it in some of its commercial applications.

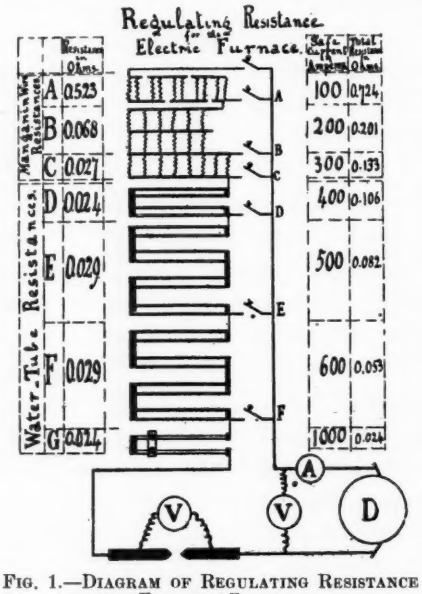


FIG. 1.—DIAGRAM OF REGULATING RESISTANCE FOR ELECTRIC FURNACES.

Frames A, B, C are manganin wire resistances, and together with the corresponding switches are mounted on a stand fitted with rollers. The other frames consist of German silver tubes fixed permanently to the wall and provided with a water circulation. D is made of ¼-inch tubes about 4 feet long, and 0.025 inch thick, E and F of ¼-inch tubes 3 feet long and 0.03-inch thick, while G is of ⅛-inch tubes 6½ feet long and 0.02 inch thick.

PART I.

EXPERIMENTAL EQUIPMENT.

In considering the equipment of a laboratory for experimental work in electrometallurgy, the point of utmost importance should be, in the first place, to provide power to enable the experiments to be carried out on a reasonably large scale. The actual magnitude of the power equipment must be regulated by two principles. It is very desirable that the experiments, though not on a scale directly comparable with the commercial process, should, nevertheless, be of sufficient magnitude to furnish reliable practical data. On the other hand, as the question of cost has unfortunately to be considered, it is necessary to keep the equipment within certain limits, so that any given experiment can be repeated frequently under all possible conditions. Such work will supply not only valuable scientific information, but also the necessary data for practical application. Having said this much with regard to the scale of work, let us consider what should be the main points governing the choice of equipment. As we shall see later, the variety of different forms of electric furnaces which have been proposed or used is extremely great, and it would be altogether impossible to provide in any laboratory, however large or wealthy, even the most important of these. With regard to the generating plant the same may be said. In commercial work we find conditions varying from the 15,000-volt nitric acid plant down to the four or five volts required by the zinc or aluminum processes; from the continuous current used in all the electrolytic work to the monophase or multiphase alternating current employed in the purely electrothermal reactions. Our object, therefore, must be not to establish a limited number of definite examples, but to obtain an equipment extremely flexible so that without serious expense any of the conditions required by such work may be obtained. It is unfortunately rarely possible to turn an ideal into a concrete fact; the development of the laboratory must necessarily be gradual, each year bringing alterations and improvements. Nevertheless, a description of the actual equipment of the electrochemical laboratory of Owens College may be of some value to those interested in the subject either from a commercial or theoretical point of view. The motive power at present available is rather insufficient, but hopes are entertained that it may before long be increased. It consists of a gas engine and motor which can be coupled on to the same driving shaft, and together are capable of developing a net output of thirty to forty kilowatts. The generating plant comprises several different types of machines.

One unit of forty kilowatts is capable of being connected so as to give any electromotive force between 10 and 200 volts, the maximum current being 600 amperes.

[1] Paper read at meeting of Manchester Section of the British Institution of Electrical Engineers, November 25, 1902.

[2] Crompton, *British Assoc. Reports*, p. 809, 1888.

[3] *Journal Soc. Chem. Industry*, vol. 20, pp. 662-676, 1901. See also Borchers, *Die Elektrochemie auf der Weltausstellung in Paris*, 1900. Halle a. S.

[4] Report of Arrhenius to Swedish Government, see *Electrician*.

[5] Humphrey, *Proc. Inst. Mech. Engineers*, 1901, pts. i and ii, p. 41; *Brit. Assoc., Sec. G., Belfast*, 1902.

[1] Bryan Donkin, *Min. and Proc. Instit. Civil Engineers*, vol. 148, pp. 1-55, 1902.

This dynamo is used for arc furnace work. Further, a dynamo especially intended for electrolytic work, capable of giving 1,000 amperes at 15 volts. With regard to alternating currents, a forty-kilowatt, three-phase, and a twenty-kilowatt, single-phase machine are provided. The latter can be connected so as to give anything between 30 amperes at 600 volts and 250 amperes at 75 volts. Finally, plant used some time ago by Mr. McDougall for the manufacture of nitric acid was presented by him to the laboratory. It will give alternating current up to 16,000 volts. Passing now from the dynamo house to the electrochemical laboratory itself, the first problem is the exact regulation of these comparatively large currents, since for satisfactorily studying some of the electrolytic processes it is absolutely essential to have the current entirely under control. The diagram of the series resistance used for this purpose is shown in Fig. 1; as will be seen, a number of switches are provided, by means of which successive portions may be short-circuited.

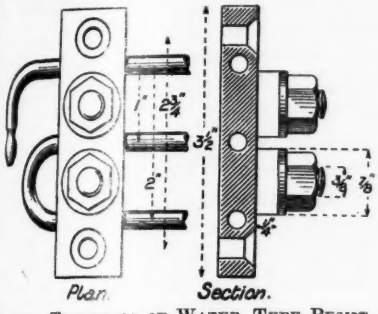


FIG. 2.—TERMINALS OF WATER TUBE RESISTANCE. (600-AMPERE FRAME.)

The German silver tubes are soldered into gun-metal strip carrying two ⅜-inch bolts. The water passes in series through several tubes, connections being made by means of a U-tube as shown in the figure. The gun-metal strips are mounted on wooden frames.

This resistance is divided into two parts, the first of manganin wire designed particularly for starting an arc furnace, and capable of being used for currents up to 300 amperes; the second consisting of German silver tubes, water-cooled, and with maximum carrying capacity of 1,000 amperes. After some consideration the water-tube resistance was chosen as being the most suitable for regulating large currents,[1] and as this subject is of some general interest we venture to give details of the design and of the behavior under actual working conditions. The details of the design of the terminal pieces of the water-tube frame are shown in Figs. 2 and 3. The frames are of two types, the first being made of parallel one-quarter-inch

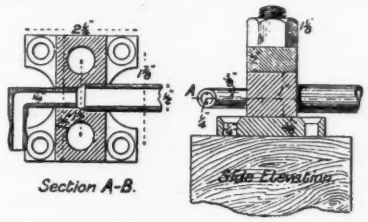


FIG. 3.—TERMINALS OF WATER TUBE RESISTANCE. (1,000-AMPERE FRAME.)

Gun-metal castings form the mounting for the German silver tube, and carry two ½-inch bolts by which the connections are made.

tubes for currents of 600 amperes and below. As will be seen, these tubes are let into one-half-inch by one-inch gun-metal strips, which are fixed on to wooden frames; each strip carries two three-eighths-inch set screws serving as terminals. One of these is used for the permanent leads, the other is useful to fix any temporary connection. The second type of frame for 1,000 amperes consists of two one-half-inch German silver tubes, six and one-half feet long, connected in series, and has a resistance of 0.024 ohm. The terminals shown in Fig. 3 are similar to those just described, but more massive. Two sliders are provided of the design shown in Fig. 4, by which the actual resistance in circuit can be varied, and the current adjusted with accuracy to the value desired.

As will be seen, there is a stiff central spring, by means of which the sliders are kept in contact with the tubes during adjustment. They can be clamped in any given position by two thumb-screws. In considering the maximum power which may be dissipated in a water-tube resistance we are concerned with two principal factors. Firstly, the maximum rate at which water can be passed through the tubes; secondly, the maximum rate at which heat can be transmitted from the metal to the water. In all practical cases the first limiting factor will intervene long before the second would show its influence. The design of the water-tube frame will therefore depend on the dimensions of the tube and the available head of water. As a general guiding factor we may say that a flow of one litre per minute will dissipate up to two and one-half kilowatts.[1]

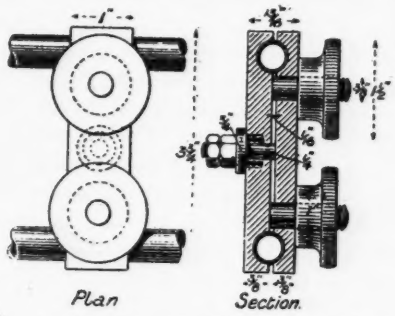


FIG. 4.—SLIDERS FOR 1,000-AMPERE WATER TUBE RESISTANCE.

These are used to regulate the larger currents, one being moved a short distance while the other remains fixed, this latter being in turn advanced. The electromotive force on the moving slider is thus kept small and sparking avoided.

Close to the water tubes a resistance is provided by which the exciting current of any of the dynamos can be most effectively regulated; it is in constant use for the considerable variations of voltage necessary during the progress of some of the furnace operations. We now come to the actual furnace equipment and the different types of apparatus which are best adapted for laboratory work. Foremost among these must be placed the Moissan

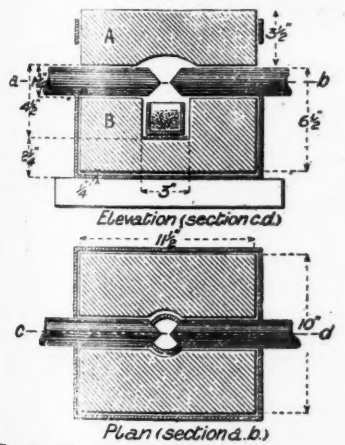


FIG. 5.—40-KILOWATT MOISSAN FURNACE.

This is constructed of blocks of Monk's Park Bath Stone, which after trials with various limestones has proved to be the most suitable. The furnace is composed of two blocks, the first A, forming the cover, the second B, the furnace proper. This latter has two grooves of slightly greater diameter than the carbons to be used. As the blocks are apt to split under the influence of the heat, they are held together by iron bands; these are provided with sockets (not shown in figure) which enable the furnace or cover to be lifted by long iron bars. The central hole, which may be of diameter 2½-4 inches, according to size of crucible in use, is lined at the bottom by a layer of powdered magnesia which prevents the carbon crucible coming in direct contact with the lime. An annular space should be left around the crucible, which not only facilitates the heating, but also prevents the lime and carbon from entering into combination.

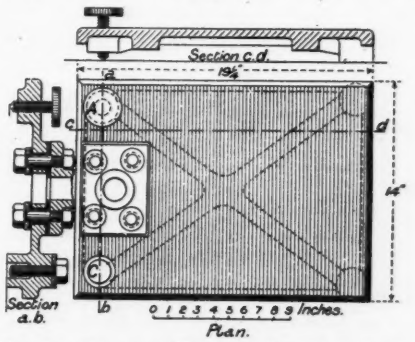


FIG. 6.—VERTICAL ELECTRIC FURNACE PLAN.

The apparatus consists of a cast-iron base, an adjustable standard, and a feeding gear. The base is ⅛ inch ruling thickness, strengthened with rims and cross-ribs 1 inch thick. At one corner a ¾-inch bolt C serves as a terminal. A is a leveling screw. The square base of the standard is insulated by a slab of vulcanized fibre, and held down by four ¾-inch bolts. See section A-B.

[1] See also *Zeitschr. für Elektrochemie*, vol. 8, pp. 6, 123, 124, 1902.

[1] The larger tubes are distinctly the more satisfactory, since in this case there is no difficulty in obtaining an efficient flow of water from the ordinary supply. With the smaller tubes it is necessary to have numerous inlets and outlets, as their resistance to the flow of water is considerable.

furnace.[1] A dimensioned drawing of this type for a power of about forty kilowatts is given in Fig. 5. Taking into consideration the many discoveries made by Moissan in the course of his investigations, it is surprising that as yet only a very small percentage have found commercial application. The reason of this may, perhaps, be ascribed to the fact that this form of furnace, though proving itself eminently suitable for the pioneering work for which it was intended, scarcely gives any data on which a technical process could be founded. It is, in fact, a striking example of how the apparatus most suited for purely scientific work is seldom capable of direct commercial application. It was not until the work was taken up by the practical engineer that the scientific discovery developed into a commercial industry. We shall see below that most frequently the financial success of a process has been in direct proportion to the mechanical improvements introduced, the chemical modifications being generally of secondary importance. It is therefore necessary to be able to provide a type of furnace corresponding in principle to the most usual technical forms, and thus carry out the experiments, if not on the same scale, at least in the same manner as would be done in the factory. Fig. 6 is a plan of an apparatus similar to that used by Haber,[1] which we have found extremely useful for representing many different forms of furnace. It has proved itself most satisfactory for the manufacture of aluminum by the electrolysis of cryolite containing Al_2O_3, replacing the carbon block C shown in this figure by a small furnace built of loose bricks, a good example of a carbide "pot" furnace giving a most satisfactory yield of calcium carbide can be obtained. Frequently in the electrolysis of fused salts it is an absolute necessity to make the crucible lining of the material itself. This result is obtained (as shown by Muthmann, Hofer and Weiss),[2] by the use of a water-cooled crucible. While the vertical holder enables us to represent a large number of different types of furnace, those of the Acheson carborundum type can be very simply built up by the use of ordinary materials.

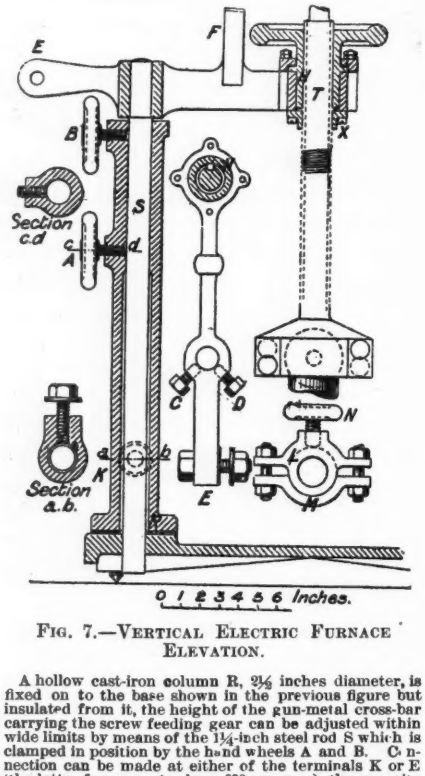


FIG. 7.—VERTICAL ELECTRIC FURNACE ELEVATION.

A hollow cast-iron column R, 2½ inches diameter, is fixed on to the base shown in the previous figure but insulated from it, the height of the gun-metal cross-bar carrying the screw feeding gear can be adjusted within wide limits by means of the 1¼-inch steel rod S which is clamped in position by the hand wheels A and B. Connection can be made at either of the terminals K or E (the latter for currents above 600 amperes), the opposite pole being connected to the base. To avoid sliding contacts which would be objectionable for such large currents connection from the cross-bar to the screw carrying the carbon rod is made by means of four ⅛-inch flexibles not shown in this figure. The gun-metal rod T, which carries the carbon, is 1½ inches diameter with a square screw thread (4 threads to the inch), giving a feed of about 1 foot; it is raised or lowered by means of a 7-inch cast-iron hand wheel. The design of the carbon holder is clearly shown; it is provided with rings of various diameter, so that carbons of very different sizes up to 3 inches can be held

The next figure (Fig. 8) is a drawing of a furnace suitable for making calcium carbide or for other furnace operations. The design is inexpensive, and the apparatus most serviceable. Such experimental equipment will be of importance, not only from an educational point of view, but it is by no means impossible that certain of the difficulties in technical processes may be overcome by its use. It is important, however, not to neglect the purely scientific work, which, though it may possibly not find any direct application in the immediate future, has, however, frequently proved to be the starting point of notable advances. In this direction the work in progress consists in the determination of the effect of gaseous pressure on high temperature chemical phenomena; it is proposed to study carefully some of the gaseous and other reactions which may be expected to differ considerably from those occurring under ordinary conditions.

(To be continued.)

[1] Moissan, *Le Four Electrique*, Paris, 1897.

[1] Haber, *Zeitschr. für Elektrochemie*, vol. 8, pp. 1, 26, 607, 1902.

[2] *Leibig's Annalen*, vol. 320, pp. 231-269, 1902.

To Vesuvius by Trolley.

The University of Naples has just sent to the Italian Government an energetic protest against Messrs. Cook's project to erect an electric tramway line, starting at the arsenal at Naples and ending at Vesuvius. The protest is of a purely scientific order. The university fears that the proximity of the electric lines will injure the delicate instruments intended for the seismic, magnetic and electric measurements.

Rubber Crop of Brazil.

A consular report states that political troubles in the Acre territory have had a serious effect upon the rubber crop of that section, and the reduction in the crop will be felt by shippers and importers. It is said that the caoutchouc forests of Peru are practically exhausted, due to the wasteful methods pursued by the gatherers, who cut down the trees in place of bleeding them. There is said to be a large source of supply of this material in Bolivia, and that with proper regulations in harvesting this will be almost inexhaustible. Experts report that enormous supplies of gutta-percha have been found in Brazil, and that there is not a tributary to the Amazon which does not show forests of the balata tree from which this is produced. Three syndicates, English, Belgian and German, are now in the field to produce gutta-percha from this source, but as yet no American firm has put in an appearance. The importance of this industry may be realized when it is known that the market price of gutta-percha is equal to that of the best rubber and the cost of production is less than one-tenth that of rubber. The discovery of these supplies is of the utmost importance. Balata fields of New Guinea and Venezuela are said to be nearly exhausted. An advantageous feature in connection with the production of balata is that it does not necessitate the great risk of life attendant upon the gathering of rubber. Balata grows upon high ground as well as on the margin of the swampy streams, and four men can gather as much balata a day as thirty men can obtain of rubber.

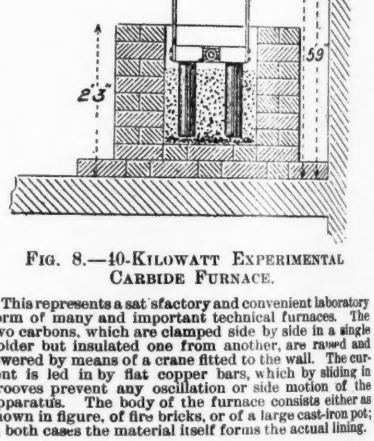


FIG. 8.—10-KILOWATT EXPERIMENTAL CARBIDE FURNACE.

This represents a satisfactory and convenient laboratory form of many and important technical furnaces. The two carbons, which are clamped side by side in a single holder but insulated one from another, are raised and lowered by means of a crane fitted to the wall. The current is led in by flat copper bars, which by sliding in grooves prevent any oscillation or side motion of the apparatus. The body of the furnace consists either as shown in figure, of fire bricks, or of a large cast-iron pot; in both cases the material itself forms the actual lining.

THE DESIGNING OF TELEPHONE APPARATUS—XI.

BY W. A. TAYLOR.

THE REPEATING COIL.

The repeating coil is really an induction coil made up into a special form. For different purposes the coil is made in different ways, depending upon whether it is to be used to ring through, whether it is to be used in central energy circuits, or merely interposed between two circuits to keep them balanced and then used for talking only.

The primary of the coil is usually of the same number of turns as the secondary. Sometimes, however, for special purposes, a different ratio is adopted. There are various ways of winding the coils in order to keep the turns and the resistance the same on each side. Fig. 29 shows a method commonly used: A, B, C, D represent four coils wound upon the wire core, E. In this coil 1 and 2 represent the terminals of the primary and 3 and 4 are the terminals of the secondary, the coils A and D forming the primary and B and C forming the secondary. In ordinary practice the both ends of each coil are brought out, as in some circuits it is necessary to connect into the middle of the primary or secondary. This form of coil is a good one for talking, but only fair for ringing. It is also quite expensive to make, for it is a very tedious piece of work to insert the wire core into the spools of wire and bend them around neatly. Where a number of these coils are placed side by side there is a great amount of cross-talk due to electromagnetic induction. For this latter reason and on account of the expense in making, ironclad coils are being made mostly. These are of three kinds: First, those with a long core composed of a bundle of small iron wires which pass through the cylindrical spool of the coils and are bent back over the outside of the coils overlapping the two ends. This may be called the hedgehog type, because of its similarity to the hedgehog transformer, which was at one time used in electric lighting. The second style is of the same form as the first, except that the whole is covered with a boiler-iron tube, the ends of which are closed with iron discs. This proved necessary because of the amount of cross-talk in the former kind. The third kind has a straight core only a trifle longer than the spool. This is placed into a tube and the ends pressed down closely against the ends of the core. This latter style is the cheapest form to make and if properly designed will perform its work very efficiently when used for either talking or for ringing through. The terms primary and secondary have been used in speaking of the winding. This is merely to distinguish between the two. In truth, either half may be spoken of as primary or secondary, depending upon which way the transmission is being carried.

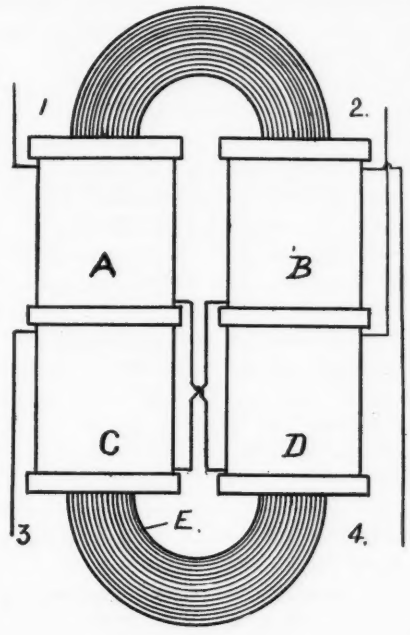


FIG. 29.

Fig. 30 is a form of winding adapted to the cylindrical repeating coil. Coils

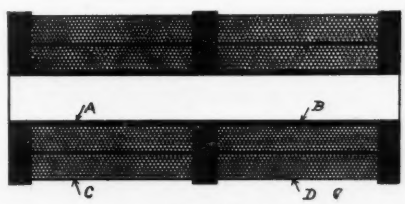


FIG. 30.

A and B are wound first, and then over these coils C and D are wound. A and C are separated from B and D by a middle partition on the spool. A and D, connected together, form one-half, and B and C the other half. Should A and B form

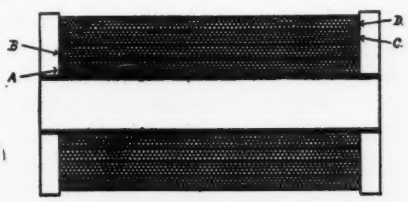


FIG. 31.

one of the windings and C and D the other, the resistance of the outer windings would be much greater than the inner. With one inside and one outside coil connected together both the primary and secondary are of the same resistance, provided they have the same number of turns. In this coil, as in that shown in Fig. 29, all eight ends are brought out in order to make it adapted to a number of circuits. This is the type of coil used by the Bell companies in their central energy systems. The coils A and D in this case being connected together through the battery, and B and C are also connected together through the same battery.

Fig. 31 shows another form of winding. Upon a straight core are wound the four coils, A, B, C and D, each of the same number of turns. The inner end of A is the one terminal of the primary, the outer end of A connects with the inner end of D. The outer end of D is the other end of the primary. The inner end of B is one terminal of the secondary and the outer end of C is the other end. The outer end of B and the inner end of C are connected together. With this arrangement of windings, both primary and secondary are of the same resistance, provided the winding of A, B, C and D each has the same number of turns and the same size of wire. This coil is used extensively for central energy work. Another form of coil is wound with two parallel wires, and still another form with four parallel wires. In each of the latter coils the wire must be double silk insulated.

Unless it can not be avoided, these last two methods should not be used, as the insulation between the two halves is very thin and likely to break down easily. The last style is used where it is necessary to have each half of the primary and also of the secondary of the same number of turns and of the same resistance. It is rather difficult to wind such a coil neatly, because of the four bunched wires. This form of coil is used where it is desired to make three telephone circuits from two metallic circuits. The lines in such cases must be balanced both for turns and resistance. It is probably better to insert a non-inductive resistance in the line than to make a coil with insulation insecure.

Where a coil is to be used in the line to ring through it must have a large amount of iron in its magnetic circuit, and the circuit should be quite short. With the comparatively light talking current, this is not necessary. The coil for good ringing must also be good for talking, and for this reason the core must be of the best annealed Norway iron wire of about Nos. 22 or 24 wire gauge. This coil must, on account of the iron, be quite large and heavy; on the other hand, the coil used only for talking may be quite small.

THE SLIDING SCALE OF RATES FOR THE TELEPHONE COMPANY.*

BY HENRY S. HERR, OTTUMWA, IOWA.

I consider this one of the most important and vital subjects before the convention. The flat-rate system, incorporated into many of the franchises granted to different independent companies by city and town councils, has been the direct cause of more poor service, poor construction and poor maintenance than any other cause that I can think of at the present time. Because of the fact that none of the independent companies was aware when they began business that to maintain a telephone system it would cost more per telephone to care for 500 than for a lesser number. And, therefore, they soon found themselves paying out more money for maintenance and operating than they were receiving. A very popular price among promoters, and a catchy price for the public is a rate of $1 per telephone, this being considered an adequate amount in telephone systems under most favorable conditions for from 300 to 500 subscribers. That is not a sufficient amount to conduct the business and maintain the plant when the number is more.

CAUSE OF POOR SERVICE.

A large number of telephone exchanges that in the beginning, when their subscribers were few in number, gave excellent service, are now giving very poor service, because expenditures consume all the receipts, and there is nothing left for repairs or maintenance. And unless financial relief comes by means of advanced receipts, a very short time will put them out of business.

The eagerness of the independent telephone people to right the wrong done the public in charging exorbitant rates by the company holding the original patent upon the telephone was the prime cause in promoting independent or opposition telephone companies. They, like the hardware or grocery men, counted that the more service they could sell the greater would be their profit, prices always being the same. One hundred barrels of sugar, or 100 barrels of nails, can be sold by the merchant for less money per barrel than one, two or three barrels, and still the merchant would make greater profit on his investment by selling the large number at the same price than by selling the small number at the same price. And thus the pioneers of independent telephony, when they turned their attention to the telephone business, thought if they could sell the service of 1,000 telephones they could make the rate the same, or even less, than if they sold the service of only one-quarter or half that number. The comparison between sugar, nails and telephone business is not a fair one. When a barrel of sugar is sold, that is the end of it, when a telephone service is sold, it is only the beginning. Forever after there are wires to be taken care of, trouble to chase, lightning and electric currents that burn up the instruments to be switched off, and the more telephones you have the longer distances are necessary to reach the subscribers, and many other things must be done. When nails and sugar are sold, the merchant receives all his cost and profits; when a telephone is placed, only a small portion of the cost is paid in the service, and years are required to balance accounts. But to give telephone service to 1,000 subscribers, a central apparatus must be provided at a cost of no less than 100 times as much as the central apparatus will cost to give service to 100 subscribers. Ten exchanges of 100 subscribers at $1 and $2 a month will bring a handsome return to the owners, where one with 1,000 subscribers at a cost of $1 and $2 per month will be a positive loss without any provision for maintenance. Still, in each case, 1,000 subscribers are served. But this is sufficient to show cause for this paper.

By the sliding scale of rates for telephone companies is meant a scale of rates based upon the number of connections given subscribers in any one system. The importance of such a rate is well understood by the older companies, as shown by the sliding scale of rates as used by the American Bell Telephone Company at the advent of independent telephone companies.

The value of the telephone to the users is in the number of subscribers who can be reached in any one system, and it is no more than just that the telephone company should receive a proportionate share of the value that the telephone is to those using it, whether for business or pleasure. And it is also fair to the users of the telephone that they should not be required to pay more than is necessary for good maintenance and good service with a fair profit to those who have invested their money in the telephone system. This equality can only be accomplished by the sliding scale of rates. If the cost of future maintenance was always known, it would be an easy matter to incorporate rates in telephone franchises. But as this is not the case, it remains a question whether or not it is wise to do so. I am of the opinion that there will be no difficulty along this line if telephone companies will do a fair and honorable business and make their rates proportionate to the service rendered, with a fair dividend for money invested. By maintaining reasonable charges, there would be no danger of competition unless it should be by some one trying to break a weaker company in order to obtain entire control and produce a monoply in such a manner as to exclude others forever, and the return to the prices charged during the life of the fundamental telephone patent.

What the sliding scale of rates should be necessarily varies with the conditions under which the company must operate. In small companies, where it is not necessary to use tall poles or aerial cable, or conduit work, placing the cables and wires underground, the rate can be less than in cities where all this is required. But no company can do business more successfully under the most favorable conditions in an exchange not to exceed 500 at a rate averaging less than $1.50 per month for all telephones. This is usually accomplished by charging $1 for residence telephones and $2 for business telephones. Above that number it will be necessary to advance the rate a certain small per cent as the number of subscribers are increased.

A number of telephone companies in the state of Iowa have been asked if, in their experience, they found the average cost of operating, including all expenses per instrument, increased or diminished with the number of telephones installed, and what would be the number, approximately, at which a $2 rate for business and a $1 rate for residence, on a full metallic system, would be profitable.

The manager of the Des Moines Mutual Telephone Company placed the number at 400 or 500. Waterloo Telephone Company, Dr. Bennett, manager, placed the number at 400 or 500. Fort Dodge Telephone Company made the maximum number at 800. The Home Telephone Company, of Oskaloosa, at 250. In Iowa City, a citizens' committee was appointed by the Commercial Club to investigate the proposed increase of rates by the Johnson County Telephone Company. After thoroughly investigating, they reported that it was unprofitable for the company to do business at a $1 and a $2 rate with 600 telephones in operation, one-half of which were business telephones and the other half residence telephones. This committee publicly announced that they were opposed to a raise of telephone rates

*A paper read before the Interstate Independent Telephone Association, Chicago, December 10, 1902.

when they were first placed upon the committee. But after their investigation they were convinced of the necessity of raising the rate to $1.50 and $2.50 until the number reached 1,000 subscribers; thereafter twenty-five cents additional. Same rate to be maintained until the number reached 1,500, when another twenty-five cents should be added. This is a fair concession by the committee appointed for Iowa City.

The Interstate Telephone Association should take some action to show its disapproval of the conduct of many independent telephone promoters in making a flat rate for an unlimited number for service for all time to come, when asking for franchises. This is untenable, because the cost of telephone construction and maintenance vary too much in different cities of the United States, particularly the maintenance, which will average fifty per cent more in some cities than in others, and it is unwise to place the cost of maintenance at less than ten per cent in any case. More than this, the association should do all in its power to enlighten town and city councils on this subject, so that they will scrutinize more carefully the franchise asked for by telephone company promoters, since such promoters generally organize these companies by issuing stock and bonds, and then construct the cheapest plant possible, taking their profit and leaving the stockholder and bondholder to take care of the situation, who soon find, to their disappointment, that they were caught in an unprofitable investment, and the council are in the awkward position of having required conditions of their telephone company which can not be carried out, excepting at a great loss and final bankruptcy. City councils are generally selected from the best men of the city, from various trades and businesses. They want to do the fair thing in such matters, but how can they when they do not understand the business. It is our duty, as an association, to agitate this question and furnish proof of the correctness of our position, so that the value of telephone properties may not be destroyed, and many men financially ruined by injurious or unwise legislation, either by the city council or by state legislatures.

Legislation on this subject is sure to come, and we need not fear it if we do our duty in this matter. Every business man wants every other to succeed. And they will come to our support if they understand the situation. They all want first-class telephone service, and that, like good goods, can not be bought at the price of shoddy. Above all, be honest with your people. Make your statements plain and truthful, and you will have a hearing which will bring you success.

THE TELEPHONE TRANSMITTER, ITS EARLY HISTORY, ITS PRESENT STATUS WITH RELATION TO THE BERLINER PATENT—PAST AND PRESENT.*

BY J. J. NATE.

The names of those identified with the microphone, or transmitter, are Boursel, Reiss, Hughes, Hunning, Cushman, Edison, Drawbaugh, Bell, Blake, Berliner, Harrison and several others. Reference is first made by Charles Boursel, who said, in 1854: "I have often asked myself if the spoken word itself could not be transmitted by electricity; in a word, if what is spoken in Vienna may not be heard in Paris. It is practicable in this way: Suppose that a man speaks near a movable disc, sufficiently flexible to lose none of the vibrations of the voice and the disc alternately makes and breaks the connection with a battery, and have at a distance another disc which will simultaneously execute the same vibrations." Reiss, scientist and electrician of wide reputation, set about a few years later the task of producing an electrical talking machine, and it is a matter of history that if he had equipped his transmitter with an adjustable spring so as to have obtained the varying pressure of electrodes in constant contact, he would have produced a practically perfect transmitter. Hughes, at about the time knowledge was given to the world that a speaking telephone had been invented, and Hunning also, began a system of experiments, using various metals, of which carbon was one, for producing a loud speaking telephone. The first English patents, the Bell and the Hughes patents—or the application, at least—are not so far apart in the British patent office.

The author then takes up in detail the Hughes and Hunning patents and makes reference to the invention of Emile Berliner and the applications of Edison and Drawbaugh. It was quite remarkable that the Edison transmitter was produced almost simultaneously with the Gray and that the two were in service and in operation in the city of Chicago as early as 1878. The author compares the statement issued by Alexander Graham Bell in his telephone patents, a description of his experiments, and the claims of the Berliner patent, and respecting Professor Dolbear's claims for the invention of a telephone in his early experiments with the transmitter, thinks that if the model submitted and the evidence presented at the time of the Pan-American suit can be relied upon, he demonstrated his claim as the original inventor of the telephone.

Perhaps among the early claimants for priority for the invention of the telephone, Cushman stands preeminently alone. About six years ago he told the author the story of his discovery and exhibited what he represented to be the transmitter used, also a map showing a pond of water. It seems that communication had been established by telegraph circuit with a teamster at some distance away. In endeavoring to arouse the operator at the distant end where the teamster was supposed to be, the line was grounded in the pond, but it was found that the telegraph outfit was either missing or out of order and Cushman constructed out of materials at hand a crude form of what he presumed or imagined would act as a relay, and after its construction attached it to the wire in series and operated it. Getting no answer back, he assumed that the device was a failure. Shortly after, the teamster drove into camp very much excited and asked if somebody had employed certain words over the wire, stating that he could distinctly make out the sound of words, and the croaking of frogs, or a sound somewhat similar in the vibrations of the relay where he was located. Mr. Cushman at that time was deeply interested in electricity and sent the teamster back with instructions to the effect that he would pronounce certain words in front of the instrument, but would not make known these words until after the experiment, when the man was to repeat them. On his return he was able to make a sufficient statement of the sound, or words used, to convince Cushman that he had invented something entirely new in the way of electrical apparatus.

The author then takes up the suit of Drawbaugh *versus* the American Bell. This suit was known as the Pan-American, and was instituted during President Cleveland's administration. It was Justice Field who said that the evidence introduced demonstrated Drawbaugh's prior invention and that his failure to advance his claims within the time limit prescribed by law nullified the force of such evidence. Among all of the early pioneers in the subsequent development of the Bell telephone monopoly, Mr. Theodore N. Vail was perhaps the most far-

* Abstract of a paper read before the Interstate Independent Telephone Association, Chicago, Ill., December 11, 1902.

sighted. The invention came to his attention while in Washington when connected with the postal service. About a year or so previous to the invention of the Bell telephone, Professor Elisha Gray delivered a lecture at McCormick's Music Hall, in Chicago, illustrating his musical telephone. This instrument was connected by wire with Milwaukee, where the receiving instrument reproduced accurately musical sounds emitted by the sound instrument at the Chicago end. These instruments were composed of metal or musical reeds, each one of a different tone-pitch and were vibrated electrically. During Professor Gray's lecture he made a statement to the effect that his experiments while developing the musical telephone had convinced him that it was possible to construct an instrument by which articulate speech could be conveyed electrically and that it was his intention to shortly bring out and experiment with such a device and in a general way outlined so truthfully his theory that when his caveat was filed in Washington a few moments after that of Professor Bell, his claims did not differ materially from his description of many months before.

Mr. H. H. Beebe, of Plattville, Wis., who was an operator there at the time, had a telegraphic wire between his house and the depot when the announcement of Bell's invention was made. Mr. Beebe designed a crude telephone which was not very clear and in his endeavor to produce an instrument of strong carrying power he constructed practically the Blake transmitter. This instrument was crude. It was made of a block of wood with the diaphragm across the front, in the back of which was an opening in the wood. In this opening against the diaphragm were suspended the two electrodes. The author was able to talk indistinctly over this instrument on a short circuit when in Plattville about two years ago.

The Berliner application and the original drawing shown in his application of November, 1880, are the same as those shown and described in his patent of November 17, 1891. This is practically true of his British patent 91, granted in 1880. Other patents were also granted to Berliner in France, in 1880, 1883, 1884 and 1886, all of which have expired, and which covered every essential point under his American patent. The author then reviewed in detail the similarity of the claims covering the Berliner application, citing other instances. During the early litigation of the National Telephone Company, the Century Telephone Company was sued for infringement by the American Bell Telephone Company under the Berliner patent. He spoke of the policy followed by the several companies interested and the organization of the National Telephone Association. Then followed a discussion of the raising of funds for the purpose of assisting the National company through this litigation. The result of this was that Judge Taylor, assisted by Judge Payson, was secured for the defence in the suit of the Bell *versus* the National Telephone companies. The result of this hard-fought battle in Judge Brown's court is of such recent date that it need not be discussed in length. The court found that the Berliner patent was invalid because at the date of application, June 4, 1877, Berliner had not made the invention covered by the patent issued to the American Bell Telephone Company, November 17, 1891. The author then reviewed the decision of Judge Brown and in conclusion took up the possibility of the reversal of Judge Brown's decision by the Court of Appeals. In the case of reversal the patent is then in full force and only the Supreme Court of the United States could determine the rights of either party. He then raised the question of what the independent telephone interests will do should the Supreme Court concur in a reversal of Judge Brown's decision. The author closed his paper by paying a grateful tribute to the electrical inventors who have made the progress in this apparatus in the last twenty-five years so marvelous.

In importations of manufacturers' materials the figures of the ten months ending with October, 1902, show an increase in nearly all articles. Importations of hides and skins in the ten months ending with October, 1902, were $48,321,871 in value against $46,692,776 in the same months of last year; chemicals, which are largely used in manufacturing, were $48,701,129 against $45,840,286 in the same months of last year; silk, unmanufactured, $29,276,097 against $23,996,628 in the corresponding months of last year; fibres, $28,933,891 against $21,198,922 in the same months of last year; tin, $17,773,089 against $16,248,810 in the corresponding months of last year; wool, $16,413,164 against $11,624,278 in the same months of 1901, and cotton, $8,050,468 against $6,000,238 in the corresponding months of last year.

At the annual meeting of the American Roentgen Ray Society, held in Chicago last week, resolutions were passed commending the Universal Exposition, at St. Louis, 1904, to the support of all electro-therapeutists.

The Water Powers of Switzerland as a Means of Generating Energy for Electric Traction on Swiss Railway Systems.

The increase in the price of coal during the last few years has caused M. Thormann, engineer at Zurich, to enquire whether it would not be possible to obtain from waterfalls the necessary electric power to move the trains of the Swiss confederation. Results of his investigations are embodied in a report which is analyzed as follows in *L'Electricien:*

The complete substitution of electric power for steam is quite possible, but it would not entail an appreciable decrease in the actual cost of operation. The five principal railroads existing to-day in Switzerland require a daily motive power of more than 30,000 horse-power. To organize a general electric service it would be necessary to have available a power of 60,000 horse-power in the form of high-tension alternate currents, to say nothing of a reserve, which would be indispensable. Without taking into account the numerous waterfalls which have so far not been utilized, there are on Swiss territory twenty-one big stations producing sufficient electricity to furnish at the present time 86,000 horse-power. M. Thormann enumerates these installations, and includes in his list the Siel station, near Libsiedel, which gives 20,000 horse-power, that of Laufenburg on the Rhine, also of 20,000 horse-power, those of Saint Moritz, of Nangen-sur-Aar, of Bernau, and of Voeggisthal, each of 5,000 horse-power, that of Ritomsee, of 8,000 horse-power, etc. It is thus seen that the twenty-one stations would, of themselves, be more than sufficient to distribute to the Swiss railroads the necessary power. The cost, however, of the transformation of the traction system would amount to the round figure of 161,000,000 francs, made up as follows: 40,000,000 for the working material, 70,000,000 for the canalization, 51,000,000 for the establishment of stations for transforming the current. It must be noted that the adoption of electric traction would have the enormous advantage of doing away with the present consumption of coal, now imported from abroad, without considering that the use of hydraulic power would encourage, to an important degree, the development of several national industries.

Following M. Thormann's publication, a railroad company solicited from the federal government the authority to make use of electric traction for testing purposes on a system of twenty kilometres of its line.

Underground Electric Tube Railways in London.

Some Gossip Concerning Old and New Schemes.

By A. Webster.

LEST it should have been overlooked in America also—it certainly seems to have been forgotten in the whirlpool of Americanism in which we have been floundering in the Parliamentary Committee rooms this year—I would remind my readers that electric tube railways were pioneered in Great Britain by the promoters of the City & South London Railway, which line will be clearly seen in the map, Fig. 1. At the date of its inauguration, 1890, the railway, which is British throughout, only ran from Stockwell to the city, but a few years later extensions were granted at either end, and the termini are now situated at Clapham and Islington. In the year of the opening of this line an unsuccessful effort was made to get a bill through Parliament for a tube running over practically the same route as the existing Central London Railway, which itself was sanctioned in 1891, but not opened to the public until 1900, the reason for this belatedness being financial difficulties. In those days, even more so than at present, investors were extremely shy of supporting any scheme of an electrical nature, and it has been this characteristic which has allowed the American millionaire such free scope in electric railway enterprise in London. In the case of the Central London Railway, for instance, the promoters were forced, by a piece of financial jugglery, to create another company which took over the whole of the construction and equipment of the line on terms, a method of procedure which was not viewed with favor at the time, and even nowadays is pointed to in the committee rooms as an example of how not to do these things, viewed from the standpoint of public benefit, *i. e.*, high capital cost not being conducive to cheap fares. At the same time the means adopted by the Central London Railway Company have amply justified the end, and the undertaking is at present in a very flourishing condition.

From Fig. 1 it will be noticed that the only other line actually in operation is the short length from Waterloo to the city, this line being designed simply in order to give facilities for reaching the city to South London residents, arriving at Waterloo. It was financed by the London & Southwestern Railway Company, whose terminus is at Waterloo, one of the main south of England steam railway companies, and has no stopping place en route. It was sanctioned in 1893 and opened in 1898. The mileage of all three lines in operation, seen in Fig. 1, is under twenty miles, which does not sound very flattering. Both the City & South London and Central London lines run immediately under main roads all the way, and the former, as well as the Waterloo & City Railway, runs under the Thames. Both maps are merely skeletons. The Bank station, seen clearly in each, is in the heart of the city of London, and the four miles radius, which is also marked, will give an idea of the length of the railways. All are on the same scale, and by keeping the lines in operation, and those under construction or yet constructed separate, the complication becomes much less.

Dealing with Fig. 2, this is largely a Yerkes map. When Mr. Yerkes first came to these shores and identified himself with the Metropolitan District Railway Company, nearly all the lines shown in this illustration were in separate hands, with but remote chances of ever being built. But in a very short space all this was changed. First of all came the registration of the Metropolitan District Electric Traction Company, whose avowed object was the electrification of the District lines. This having served its object as a bait for Parliament and, to a certain extent, the public, a much larger scheme was propounded by which the Metropolitan District Electric Traction Company voluntarily wound itself up and gave place to the Underground Electric Railway Company of London, Limited, with a capital of £5,000,000 guaranteed by Messrs. Speyer. In addition to electrifying the District company's system, however, this company secured control of the following lines, all of which are seen in Fig. 2, *viz.*, Baker street and Waterloo sanctioned in 1893, a line which would probably have never fallen into Mr. Yerkes's hands had it not been already mixed up in the failure of the London & Globe corporation; Great Northern & Strand Railway sanctioned in 1899; District Deep Level sanctioned in 1897; Brompton & Piccadilly Circus Railway sanctioned in 1897, and the Charing Cross, Euston & Hampstead Railway sanctioned in 1893. The Edgeware & Hampstead line, which is a continuation of the latter, was sanctioned this year, and is also included in Mr. Yerkes's scheme. It runs partly in the open air, and is the first of such railways ever sanctioned in Great Britain. To supply the motive power for all these "tubes," the Underground Electric Railway Company, of London, is building a 50,000-kilowatt generating station, and by virtue of the fact that this is well on the way toward completion, and that in some cases tunneling has been commenced, I have drawn them on the map as "under construction." Inasmuch as the Inner Circle is so closely allied to this scheme of Mr. Yerkes's, it is also shown in the map. The one other railway shown in Fig. 2, the Great Northern & City Railway, was sanctioned in 1892 and is quite distinct in itself. The whole of the tunneling work is completed, and the power-house is well advanced. One outstanding feature of the line is that the tunnels are sixteen feet in diameter as against the usual eleven feet six inches on such lines. Thus the Great Northern & City will be capable of accommodating the rolling stock of ordinary steam railways, the inability to do, which on the part of the others, immediately puts them out of court in respect of any scheme of intercommunication between steam and electric railways.

Besides the above lines, the only other one sanctioned prior to 1902 is what is known as the Northwest London, which runs from Marble Arch in the west to Cricklewood in the north of London. No scheme for the construction of this has yet been formulated, however, albeit an extension of time for the carrying out of the project was allowed by Parliament this year. It is seen dotted in Fig. 2.

From the time of the inception of tube railways in 1890 down to 1899, the various promoters advanced their schemes with an almost utter disregard for anything that might come afterward and, in a way, isolating themselves altogether. This state of affairs being brought to the notice of Parliament, a joint committee of the House of Lords and the House of Commons was appointed in 1900 to enquire into the matter and, if possible, to lay down certain suggestions which would

guide future promoters as to the best way to lay out their proposals for public utility, and such recommendations were to be afterward carefully considered by Parliamentary committees dealing with tube railway bills. One result of the appointment of this committee was that during the Parliamentary session of 1900-1901 all tube railway bills were suspended. When the report of this committee was finally published it contained a large number of recommendations which had never, at any rate, been put into practice on the existing lines. Included in them were the erection of emergency platforms alongside the tunnels for passengers to walk along in case of accident. With this came a larger tunnel, of course, than had hitherto been adopted. The report also laid down that where possible the routes of such tubes should follow the main lines of surface traffic, and that, further, through routes from end to end of the metropolis were desirable. The result of all this was that in the session of 1901-1902 Parliament found itself with some fifteen to twenty bills to consider, which number comprised several held over pending the result of the sittings of the joint committee. And it was only when the bills came before the committee that the public became acquainted with the fact that Mr. Morgan had entered the field and would actively oppose Mr. Yerkes as a lively competitor as regards the anticipated traffic on the soon-to-be transformed Inner Circle and its associated "tubes." Ultimately Parliament, for the first stage before the House of Lords, divided the bills into two groups presided by Lord Windsor and Lord Ribblesdale, respectively. The latter had but little in the way of arduous work to perform, his chief duty consisting of granting extra time to lines which had not succeeded in opening within the period prescribed in the original bills. Apart from mentioning the fact that this committee sanctioned the first open-air electric railway over here, *viz.*, the Hampstead & Edgware line, its doings may be altogether ignored.

It was before Lord Windsor's committee that the great fight between Messrs. Yerkes and Morgan began. As already mentioned, Fig. 2 will show the former to be in a strong position as far as concessions acquired are concerned, and in this respect must be considered as having a considerable start. He claimed, as he perfectly naturally could, that this scheme, together with functions with all the steam railways touching his lines, gave accessibility all over London. On the other hand, so much remains to be done in the actual construction and equipment of these lines that Messrs. Morgan were perfectly justified in arguing that any new lines granted to them could be constructed just as quickly. Hence in conjunction with the London United Electric Tramways Company, whose tramway system works to the left of and joins up with the terminus of the Central London Railway at Shepherds Bush (Fig. 1), Messrs. Morgan asked for a line from Shepherds Bush, which would, first of all, come south (say an inch and a half on the map), then run parallel with the Central London to the city, and then take a sharp turn to the north and feed the district lying beyond Finsbury Park, seen in Fig. 2, thus affording very considerable and emphatic competition with Mr. Yerkes's system as

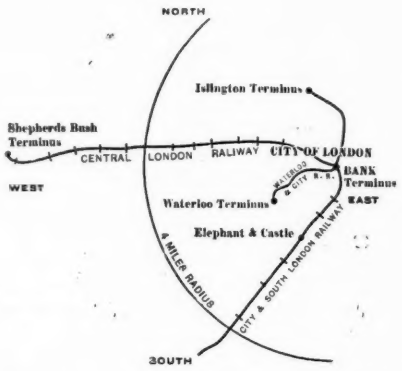


FIG. 1.—RAILWAYS ALREADY IN OPERATION.

a whole. In addition to this, however, the Central London Railway Company came forward with a duplicate proposal to Mr. Morgan as far as the city only. Altogether, there were four proposals for lines to the city from Hammersmith *via* Piccadilly, and any one except the two American millionaires were felt to stand a poor chance, by reason of the ability of these two latter to find the money offhand for building the lines. The reason for the great rush on this particular route was that a railway along there was recommended by the joint committee, hence the sole remaining difficulty was the question of finance and engineering. Lord Windsor's committee sat for three months early in the year threshing out the problem. The engineering proposals need not be entered into here, as railways or other schemes are not always carried out as they are described to Parliamentary committees. The upshot of it all was that the scheme proposed by Morgan and the London United Tramways Company was allowed to go through, and Mr. Yerkes was also granted his necessary extensions, which enabled him to serve Piccadilly.

At this stage (*i. e.*, in June) the bills were passed on to be dealt with by the House of Commons, and this is a peculiarity to the uninitiated with regard to English law, *viz.*, that the same procedure has to be gone through in the House of Commons as takes place in the House of Lords, and that after one house has passed a scheme, the other house may reject it. However, toward the middle of July, the bills reached the committee stage of the House of Commons, where it took nearly a fortnight to enquire into Mr. Yerkes's schemes. Naturally less difficulty was experienced than when before the lords, and Mr. Yerkes's scheme was allowed. The time at the disposal of the committee was then found to be too limited to permit of completing Mr. Morgan's bills before the Parliamentary recess which lasted from August to October, and so these were postponed.

After an interval of nearly three months proceedings were recommenced in October with a most startling denouement, *viz.*, the breaking up of the partnership between Messrs. Morgan and the Tramways company, by which the latter withdrew altogether, leaving Messrs. Morgan stranded so far as this session is concerned, and this after an expenditure estimated at $500,000 in Parliamentary legal expenses. The effect of this announcement in the committee room set every one agog with excitement as to what would follow. The *pièce de résistance* of the whole thing was when it came to light that Mr. Yerkes had, through the instrumentality of Messrs. Speyer, secured some control in the London United Tramways Company, truly a most startling reversal of forces. Both Mr. Morgan and Mr. Yerkes have friends in several members of Parliament, but despite a determined effort on the part of the former to secure a special hearing under the exceptional circumstances, it pleased Parliament to stick to the rules of the House, *viz.*, that a committee's decision being given, there can be no going back upon it. As the committee had already decided that without the cooperation of the tramways company Morgan could not fulfill the promises made to the House of Lords, the only consolation left to him is that he can make another effort next session, but he is badly handicapped. One important fact made clear in all this is that Parliament itself is by no means favorably disposed to the introduction of the American millionaire in this matter, and the

individual members expressed themselves in no uncertain manner on this point. As far as the public are concerned, they seem satisfied and pleased that electric railroading in London has not, for the present, fallen into the hands of two such magnates as Yerkes and Morgan, it being felt that between the two the public would have but a scant chance. Few matters of electrical interest have absorbed the attention of the general body of the people to such an extent as the tube railway bills of 1902, but here, at present, ends one of the most memorable sessions in the annals of the history of the industry.

In the meantime, the outlook is by no means pleasant from the point of view of material benefit to traffic congestion by this means of locomotion in the metropolis. Yerkes seems determined to come again next year to seek powers over the route where Morgan failed. Morgan will probably have another try himself in a spirit of pique, and the Central London Railway promises to revive its scheme rejected this year, in addition to which there are possible others. Those who can view the situation with pleasure are the lawyers, and inasmuch as the whole forest of details which has been hung, drawn and quartered this year, will have to be served in a like manner in 1903, these latter gentlemen have a bright prospect before them. The London County Council, growing impatient at the disunited efforts of the company promoters in the matter, is seriously considering striking out on the tube railways itself, an action which will raise a hubbub probably not yet equaled against municipal trading.

With all due respect to American traditions of progress, we can not help feeling that between Yerkes and Morgan they have succeeded in putting a stopper at a most inopportune moment upon progress in a direction which can ill afford retardation, and in spite of a great show of industry on the part of the Underground Electric Railways Company, of London, in booming its power station at Chelsea as the largest in the world for the purpose. Londoners thank the American millionaires for stifling, if only temporarily, our normal rate of progression. It will all probably result in some drastic action by Parliament.

FIG. 2.—RAILWAYS IN COURSE OF CONSTRUCTION.

The Size of Atoms.

During the discussion of the paper on the "Size of Atoms," which was read by Mr. H. V. Ridout at a recent meeting of the British Physical Society, and which was reprinted in the ELECTRICAL REVIEW, November 22, Lord Kelvin remarked that he had often concerned himself with the size of atoms, and pointed out that the value obtained by the author for the diameter of a hydrogen ion was almost exactly one-half of that which he had obtained for the diameter of a molecule of hydrogen. The fact, however, might be a coincidence. He had dealt with a sphere which would have the same effect as a double atom of hydrogen. While avoiding the assumption that atoms are hard and spherical, it was usual to treat them as such for purposes of calculation. The paper was an important one, but there were many assumptions which required looking into.

Lord Kelvin said that in dealing with the subject of atoms it was necessary to consider the atoms of electricity. The atomic theory of electricity, now almost universally accepted, had been thought of by Faraday and Clerk Maxwell and definitely proposed by Helmholtz. The atoms of electricity were very much smaller than the atoms of matter, and permeated freely through the spaces occupied by these greater atoms, and also freely through space not occupied by them. An atom of electricity in the interior of an atom of matter experienced electric force toward the centre of the atom.

We were forced to conclude that every kind of matter had electricity in it, and Lorenz had named electricity as the moving thing in atomic vibrations. If the electrions, or atoms of electricity, succeeded in getting out of the atoms of matter, they proceeded with the velocity of light, and the body was radioactive. It was, therefore, not surprising that some bodies showed radioactive properties, but rather surprising that such properties were not shown by all forms of matter. Our knowledge of this subject, which originated with the discovery of the Becquerel rays, had been greatly advanced by the experiments carried out at the Cavendish Laboratory, and he had no doubt that in the next two or three years much light would be thrown upon this important matter.

Iron and Steel.

The latest figures of the Treasury Bureau of Statistics show that the importations of iron and steel manufactured in the ten months ending with October, 1902, are double those of last year, and three times as much as those of 1898. These are also larger than in any year since 1891. The total value of iron and steel manufactures imported in the ten months ending with October, 1902, is $31,987,056, as against $16,349,427 in the same months of last year, and $10,531,090 in the corresponding months of 1898. In practically every class of articles the figures of the year just ended are larger, both in quantity and value, than those of last year, and in many cases the figures are more than double those of last year.

THE ENGINEER OF THE TWENTIETH CENTURY.*

CHARLES F. SCOTT.

It is significant that the response to this toast is assigned to the representative of the Engineers' Society of Western Pennsylvania. This society represents the engineers in Pittsburg, the city above all others preeminent in its industrial and engineering works in the country which is assuming the industrial supremacy of the world. The inventions and the designs of the engineer underlie Pittsburg's products, under his supervision they are made, and in turn Pittsburg's products are the materials which other engineers employ in buildings and railroads and power plants throughout the whole world. A week ago a Philadelphia paper quoted a multi-millionaire thus: "Pittsburg instead of Wall street must be considered hereafter as a potent factor in the continuation of our national prosperity." When money rates go up in Wall street and wage rates go up in Pittsburg simultaneously, it is the industrial thermometer which most truly indicates the real conditions. Enter engineer, exit speculator.

It is significant also that the response to this toast is assigned to the representative of the American Institute of Electrical Engineers. This organization represents the electrical engineers of America, the country above all others preeminent in electrical activity at a time when its applications are making this the age of electricity. For a retrospect of general engineering we appealed to the memory of men past middle life, but the electrical awakening is within the easy memory of us all.

Electrical work is seldom independent; it does not stand alone; complete in itself. Electricity is usually an agent, a means to an end. It is not energy derived from electricity which enables the car to move and the crane to lift a weight, it is the power from the engine which happily can be transmitted by electric wires better than by cables, or shafts, or belts. It is because electricity is primarily an agent, a means, that its applications have been so diversified, so extensive and so far-reaching in their effects.

The great discovery of the nineteenth century was cooperation, the effectiveness of concentration, the efficiency of largeness. Compare the old days of the hand loom in the home, of the shoemaker at his bench, of the individual oil well and coal mine, of the small railroad and of the small factory—compare these with modern methods, with their unbounded possibilities—possibilities of good, and possibilities of evil; of good, because the engineer has provided the means for doing the world's work more efficiently; of evil, because the social, the industrial, the commercial systems have not kept pace with the advance made by the engineer, for they are tainted by injustice and by selfishness.

The tendencies of the nineteenth century projected into the future reveal, in dim outline at least, the engineer of the twentieth century.

He is to become a greater factor in adjusting and operating the intricate mechanism of a new civilization. He is to deal with large affairs in a large way. He is to be closely related to every department of modern life. He will be advanced to administrative positions for which his knowledge and his training peculiarly fit him. At the head of the Pennsylvania Railroad, directing its vast affairs in the present and planning to meet the demands of the future, is President Cassett, an engineer surrounded by engineers. At the head of the interests with which I am connected is a man successful as organizer and manager and financier, a genius in his foresight, George Westinghouse, an engineer. Sound judgment, breadth of view, integrity, character, the ability to understand and to control men as well as matter, to direct human forces as well as physical forces are essential to the engineer who is to meet the coming demands. Besides the new relations to others there will be new relations of engineers among themselves. All that I have said so far emphasizes what we all know, namely, that the several branches of engineering are intensely interdependent and corelated. Take a single instance of large work, the extension of the Pennsylvania Railroad into New York city, the tunnels under the Hudson and East rivers, the terminal facilities and the electrical equipment and endeavor to name an important branch of engineering which is not essential to this undertaking.

The work of the future demands cooperation, not clannishness—unity, not antagonism. Engineers must be specialists; therefore they must work together. The several branches of the profession have their individual interests; they have a larger common interest. Is it not time that we, too, apply to ourselves the great lesson of the last century? What organization stands before the world as representative of the engineering profession? Has the engineer been accorded the recognition and the reward which are his due? In what way do engineers present themselves to other professions? In what way do engineers cooperate to advance their own profession by mutual helpfulness and by undertaking methods which advance the efficiency and the usefulness of engineering work? There are national organizations of various kinds, the civil, the mining, the mechanical and the electrical engineers, the architects, the naval architects and marine engineers; there are engineers in the army and the navy, and there are the chemists, the electrochemists and others. In general, each knows that the others exist, and they are mutually respectful; but there is some suspicion here and there that the other societies are a little too exclusive, or a little too common, or that others are a bit jealous. These are the murmurings of littleness, not of largeness.

The several engineering professions like the constituent states have their representative bodies, their legislatures, but why not an engineering congress as well? Why not a national representative body to stand for the profession of engineering, to promote a harmonious cooperation which will strengthen each and elevate all?

An incident of the past year is an auspicious omen. Four great societies have cooperated, they have worked together, they have taken a step which will bring recognition to the deserving individual and credit to the engineering profession, they have founded a medal and at a magnificent dinner they have announced the award of the first John Fritz medal to John Fritz himself. But not less significant than the medal is the discovery that the societies can work together, and by doing so they can accomplish worthy ends.

In the vision of the future may we not discern a reflection of the John Fritz medal in the larger life of the twentieth century engineer? Methinks I see the outlines of the medal taking the form of a magnificent building, the Capitol of American Engineering. Into this home in the metropolis are gathered the great engineering societies from their scattered lodgings. Here is a great technical library, here are ample assembly halls and comfortable parlors, here are the headquarters of a score of lesser societies, affiliated in their work but restricted in their scope. I see all over the country innumerable local societies and engineering clubs, no longer isolated, but joined together into one great combina-

*Abstract of address at the twenty-fifth anniversary, Engineers' Club of Philadelphia, December 6, 1902.

tion. I see them affiliated with the national bodies—sometimes as local chapters—altogether constituting a great union. There is individual freedom, but general cooperation. The engineering congress representing all the engineering professions and supported by the great union of engineering societies give engineers a rank consistent with the importance of their work; it increases the efficiency of the interrelations among engineers and is powerful in advancing the common interests of engineers and to represent the engineering profession in its relations to other professions, to pure science, to education, to legislation, to public improvements and to the general welfare. Years ago engineers were individuals of trivial consequence compared with men in the learned professions. Now technical professions are of recognized importance. But the men who are mastering the powers of nature will yet rise in the strength of united effort to meet the increasing responsibilities of the coming years. For it is theirs to build the foundation of the new civilization, it is theirs to establish material prosperity—the underlying conditions for broader, fuller and higher life.

The end of engineering is usefulness, the characteristic of America is activity, the modern method is cooperation. As engineers of the twentieth century let us be useful, let us be active, let us cooperate.

New Electric Power Transmission Developments in California.

The Northern California Power Company, which furnishes power to a great variety of industries in one of the most prosperous sections of California, has recently installed a 4,000-horse-power generating plant at the Cow Creek station in the high Sierras. The ultimate capacity of the station will be 8,000 horsepower when the demand for power reaches this amount. The company has already installed 3,000 horse-power at another generating station, known as the Battle Creek station, thus making the present total capacity of the company's electrical installation 7,000 horse-power. The apparatus, which has recently been installed in the Cow Creek station, consists of two 1,500-kilowatt, three-phase Westinghouse alternators, which will be driven by impact water-wheels supplied with water under a head of approximately 900 feet. The exciters, switchboard and raising transformers for this station have also been purchased from the Westinghouse Electric and Manufacturing Company. The transmission will be at 34,000 volts. The Battle Creek station is likewise equipped with Westinghouse apparatus.

Book Reviews.

"Electricity and Its Similitudes." Charles H. Tyndall. Fleming H. Revell Company. Cloth. 215 pages. 5¼ by 8 inches. Furnished by the ELECTRICAL REVIEW at $1.00.

This is practically a religious publication. Those simply desiring information on the subject of electricity will hardly seek it here. To bible students and teachers who desire scientific illustrations of spiritual truths and who possess no technical knowledge it may prove valuable. The subject is treated with extreme simplicity. The information conveyed is exact. Numerous and lengthy quotations from scientific works and journals add to the authority of the book on its scientific side, but detract from any literary merit it may possess.

"Manual of Rural Telephony." J. A. Williams, Cleveland, Ohio. Manual Publishing Company. Cloth. 77 pages. 5¼ by 7¼ inches. Furnished by the ELECTRICAL REVIEW at $1.00.

This book is intended as an elementary and practical treatise on rural telephony. The first part is devoted to a discussion of the organization of companies and gives suggestions for their proper management. The second part takes up telephone lines and their principles. The various phenomena met with are discussed in a simple way and all accessories are illustrated and described in detail. Complete wire diagrams for the various systems are given.

The book contains a large amount of practical information and should be very acceptable to those whose knowledge of this side of telephony is slight.

"The Transactions of the National Electric Light Association." New York. James Kempster Printing Company. Cloth. 720 pages. 6¾ by 9½ inches. Illustrated. To be secured only by becoming members of the association.

The value of this publication is well known, containing as it does the transactions of one of our most important industrial associations. In this volume are found the papers presented at the twenty-fifth convention of the association, held in Cincinnati last May. The ground covered by these papers is very broad. Here the station manager can find information concerning the value of creosoting wooden poles, the proper efficiency for incandescent lamps, polyphase distribution for city lighting, the photometric value of arc lamps, protection of long-distance transmission lines—in fact, on nearly every phase of the electric lighting industry. Nor is the office work neglected, for one session of the convention was given up to discussion of this important side of the business. The question box brought out many points for discussion, and the operating engineer will here find information of the most valuable and practical kind. This volume is considerably larger than that of last year, indicating in this way the increase in importance and amount of work accomplished by the association. Containing as it does information to be obtained in no other way, this book should be found in the office of every electric lighting company in the country.

"Elements of Electrical Engineering." Tyson Sewell. D. Van Nostrand Company. Cloth. 332 pages. 6 by 8 inches. Furnished by the ELECTRICAL REVIEW at $3.00.

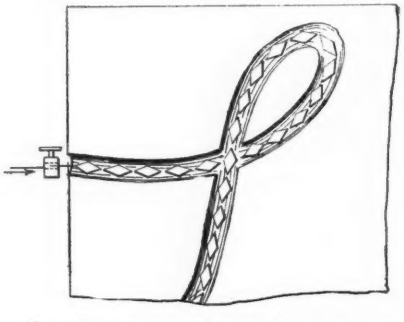
This book is based upon courses of lectures delivered by the author to classes of students desirous of qualifying as electrical engineers and is now published in the hope that it will prove valuable to numerous students who are to be found attending courses of instruction at polytechnic and technical schools. The subjects are treated very simply and mathematical processes, other than the very simplest, have been avoided.

The first chapter is devoted to a discussion of Ohm's law and here the author appreciating the difficulty most students have in grasping this fundamental principle of electrical science, has spared no effort to present it in as many ways as possible. In a book of this class the hydraulic analogy is permissible and here the author uses it to good advantage. The discussion of series and parallel circuits is also good, the author making use of many numerical examples which serve to bring home to the student the fundamental principles of electrical conduction. The heating effect of electrical currents is carefully studied as well as the magnetic effects. The many types of electric meters are explained in detail and their application shown.

Arc lamps and incandescent lamps are studied at length and the method of manufacture explained. The continuous-current dynamo and motor are considered in the last chapters, but the study here is necessarily elementary. The book should prove an excellent one for the purpose for which it was written, but it is to be regretted that the title is somewhat misleading. Very little strictly engineering work is touched upon. Throughout the entire book numerical examples serve excellently to emphasize the principles under consideration.

Electrical Patents

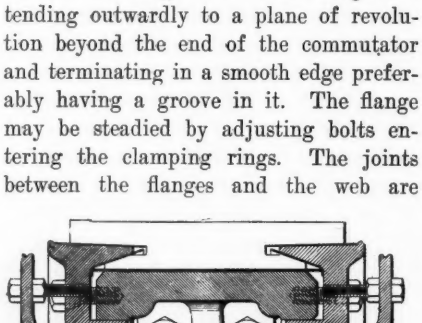
M. Emile Placon, a Frenchman residing in Lingevres, France, has patented in this country an electrically illuminated sign. The signs are made as follows: The name or the design to be advertised is engraved on a glass plate in such manner that all the lines or letters which form the word, the name, the picture, the escutcheon, or the like are connected with each other and run continuously from one end of the glass plate to the other. The glass plate may be of any color, and



New Design for Making Illuminated Signboards.

the grooves, forming the lines of the signs to be advertised, are lined with any suitable material of a color, contrasting with the color of the glass plate to make the sign visible in the daytime. For this purpose, for example, small strips of colored glass can be used. The lining material must in any case be chosen so that it is not acted upon by the electric current. On the glass plate with the engraved sign another plate of clear glass is secured, so that the first plate is entirely covered and the signs can be seen through the upper plate. To illuminate the sign, an electric current is used, which can be applied in several ways. For example, small metal plates may be fixed in the grooves forming the sign in such a manner that the points of the different metal plates are somewhat distant from each other. These metal plates are, of course, applied to the grooves before the aforementioned cover-plate is fixed. To both ends of the groove electric wires are connected in the well-known manner, and the electric current is sent through these metal plates, the letters thereby becoming lighting tubes. Another manner of illuminating the sign is as follows: The ends of the grooves forming the sign are covered at the edges of the glass plates by metal plates after a vacuum has been obtained in the grooves. When the electric current is connected to the two metal covers, the continuous tube which forms the sign becomes luminous, similar to the Geissler tubes.

Mr. William F. Dawson, of Schenectady, N. Y., has devised an oil guard for commutators, and the patent obtained thereon is controlled by the General Electric Company. The invention relates to dynamo-electric machines, and especially to generators connected directly to steam engines or other prime-movers. In these machines serious trouble frequently occurs, owing to the leaking of oil from the shaft-bearings, eccentrics, crank-pins or other lubricated parts and its working into the commutator. The creeping of the oil into the commutator is owing to the centrifugal force of the rotating parts and the outward radial suction of air due to the fan action of the commutator leads and armature spider. Ordinarily the oil follows out along the spider-arms and works through the joints between the flanges and the rim, and so gains access to the commutator. The invention consists, first, in a barrier cast integral with the spider-arms and consisting of a web, concentric with the shaft and extending from arm to arm entirely around the spider. To each edge of this web is bolted an integral annular flange extending outwardly to a plane of revolution beyond the end of the commutator and terminating in a smooth edge preferably having a groove in it. The flange may be steadied by adjusting bolts entering the clamping rings. The joints between the flanges and the web are



Oil Guard for Dynamo or Motor.

preferably rabbeted and are machined to give a close fit. The oil escaping along the arms of the spider will be stopped by the web and compelled to flow out over the flanges, from whose edges it flies off by centrifugal force in lines which carry it clear of the commutator. Any oil remaining on the edges of the flanges when the machine stops will not be able to run down inside the flanges, but will be caught in the grooves and will follow them around to the lower side of the flanges and drop off.

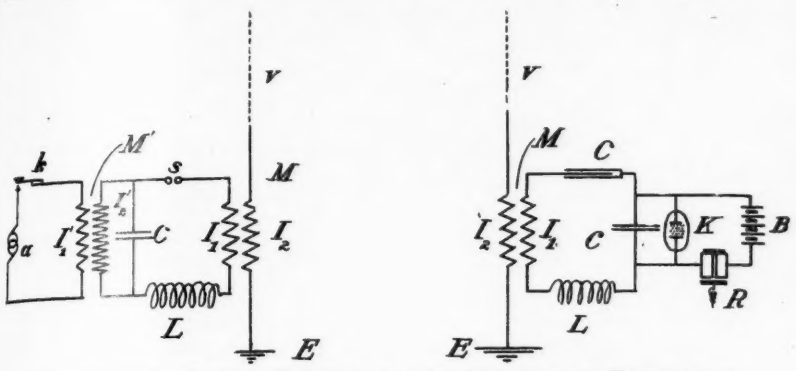
Recent Patents in Wireless Telegraphy.

It is a generally accepted opinion among telegraph engineers that unless some method of wireless telegraphy is developed by which a sending station may communicate with any one station within its district without interfering with other stations, or itself being interfered with, the practical use of this system of communication will be very restricted. For this reason, a series of patents issued recently to Mr. John Stone Stone, of Boston, Mass., is very important, as these cover broadly a method and apparatus for securing this desirable result.

If the electrical equilibrium of an electrical conductor be abruptly disturbed, and the conductor thereafter left to itself, electric currents will flow in it which will tend ultimately to restore the condition of equilibrium. These currents, which may be either unidirectional or oscillatory in character, will send out electromagnetic waves which may be used for exciting a suitable receiving apparatus. In general, these oscillations will be more or less complex, and will affect receiving apparatuses at many stations within the neighborhood. If, however, the receiving stations can be so designed that they will respond to electromagnetic waves of but one period, and a transmitting station can be so arranged that it will send out electromagnetic waves of the same period, it is evident that the latter will be able to transmit signals to the former. Moreover, if there is in the neighborhood of the transmitting station another receiving station which will not respond to electromagnetic waves of that frequency, it is evident that these signals will not be received by, nor interfere with, the working of these other stations. A method of selective electric signaling may therefore consist of transmitting stations designed to send out electromagnetic waves of certain definite frequencies, and of receiving stations designed to respond each to a definite frequency. This is the method of selective electric signaling developed by Mr. Stone, and the method by which he accomplishes this, and his apparatus, are the subject of these patents.

In order that the vertical conductor at the transmitting station shall generate harmonic electromagnetic waves of but a single frequency, forced electric vibrations are set up in this conductor in lieu of inducing natural vibrations as has heretofore been practised. In order that the electric translating apparatus at the receiving station shall be operated only by electric waves of a single frequency,

and by no others, a resonant circuit or circuits, attuned to the particular frequency of the electromagnetic waves which it is desired to have operate the translating devices, are interposed between the vertical conductor at the receiving station and the translating or recording devices.



FIGS. 1 AND 2.—SHOWING, RESPECTIVELY, THE CIRCUIT AT THE TRANSMITTING AND RECEIVING STATION.

A resonant circuit as referred to above may consist of a circuit containing simply a condenser and a coil having no iron in its core. If a charge of electricity be imparted to the condenser and its electrodes be then connected to the coil, an isochronous oscillatory current will be developed in the circuit in the process of restoration of its electric equilibrium. The period of the oscillations depends upon the electromagnetic constants of the circuit. Two or more circuits may be associated together, in which case each may modify the natural period of the other.

The transmitting station then consists, first, of a circuit or circuits containing a condenser and a coil, and having a certain period of oscillation; a means of disturbing the equilibrium of this circuit, and in this way setting up electric currents of a definite frequency, and a means of using these oscillatory currents to set up electromagnetic waves of the same frequency. Such a system is illustrated in Fig. 1. *a* is an alternator, *k* a key, and I'_1 the primary winding of a transformer, M'. I'_2 is the secondary of the transformer which serves to change the potential of the condenser, C. L is an inductance coil by which the circuit may be tuned. *s* is a spark-gap, across which the condenser discharges, and in this way sets up electrical oscillations in the circuit CLI_1s. I_1 is the primary of a transformer, M, by means of which the electrical oscillations of the same frequency are set up in the secondary coil, I_2, of the transformer and in the vertical wire, *v*. One end of this vertical wire is connected to the ground. The oscillations set up in this wire are independent of its natural period.

At the receiving station, shown in Fig. 2, a vertical wire receives the electromagnetic waves sent out from the transmitting station. These set up in the wire electric disturbances of a similar frequency, and by means of the transformer, M, these are transmitted to the receiving circuit, $CCLI_1$. If this receiving circuit has a natural period equal to that of the electromagnetic waves received, it will respond, and electric oscillations of some magnitude will be set up in it. If these are of sufficient magnitude, they will cause the coherer, K, to cohere, and thus, by means of the local battery, B, actuate the signaling device, R.

The system may be further improved by adding a second resonant circuit at each station, having the same frequency as the first. In this way the signals sent out from the receiving station must pass through two resonant circuits, and this will tend to weed out, and screen the vertical wire from, any harmonics which might be due to the circuit by means of which the oscillations are set up in the resonant circuit. In the same way, a second attuned circuit added to the receiving apparatus will assist in preventing any electromagnetic waves of frequencies other than that desired from affecting the receiving device. Each transmitting or receiving wire may have one or more attuned circuits associated with it, as shown in Fig. 3, or each station may have a number of vertical wires, each having its particular transmitting or receiving circuit.

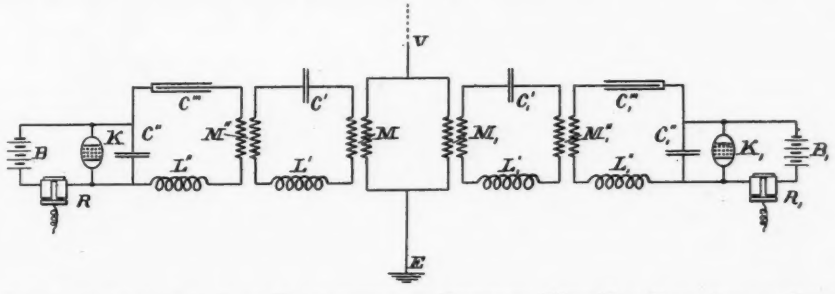


FIG. 3.—SHOWING HOW EACH TRANSMITTING OR RECEIVING WIRE MAY HAVE ONE OR MORE ATTUNED CIRCUITS.

The claims allowed in these patents cover the method of developing free or unguided simple harmonic electromagnetic signal waves of a definite frequency in an elevated conductor, and the system, as described above; an elevated conductor and means for developing therein these electric vibrations; the method of absorbing energy of electromagnetic signal waves of one frequency, which consists in associating with an elevated conductor a circuit resonant to the frequency of the waves; the method of rendering a circuit resonant to a given high frequency, which consists in balancing the reactance of an air condenser by the reactance of a coil, the amplitude of whose potential energy is small compared to the amplitude of its kinetic energy at the given frequency; the method of developing free, simple harmonic electromagnetic signal waves, which consists in discharging a condenser through a closed circuit having inductance adapted to produce simple harmonic vibrations, and impressing these upon the elevated conductor. The claims also cover the method and apparatus of selectively receiving these harmonic vibrations as described above.

Another patent issued to the same inventor covers, in a system of space telegraphy, an electric translating device constituting one of the tuning elements of a resonant circuit, and adapted to utilize in its operation the potential energy developed in said resonant circuit and the use of a condenser telephone for this purpose.

Further patents issued to the same inventor cover the method and apparatus for developing high-frequency, simple harmonic electromagnetic signal waves, and causing these to inductively reproduce corresponding oscillations at increased amplitude in an elevated conductor.

Reviews of Current Engineering and Scientific Literature.

Giving Concisely the Substance of Important Papers in the Scientific, Electrical and Engineering Press of the World.

The Theory of the Aluminum Anode.

This is a brief abstract of a paper presented by Messrs. W. W. Taylor and J. K. H. Inglis to the British Physical Society. Aluminum is very slowly acted upon by dilute sulphuric acid, even at a moderately high temperature. With hydrochloric acid its action is violent, and it is found that if a little hydrochloric or soluble chloride be added to dilute sulphuric acid the action is as violent as with hydrochloric acid of the same concentration. This paper attempts to explain these facts. When aluminum electrode is used in a solution of a sulphate, or sulphuric acid, there is a very great resistance offered to the current by a film which forms on the surface of the electrode. Many experiments were made with a cell consisting of aluminum and platinum electrodes, and a dilute sulphuric acid to which salts were added and their effects investigated. The author holds that the presence of certain ions enables a large current to pass through the cell, the reason seeming to be that the film of aluminum hydroxide with which the anode is covered is permeable to certain ions, but impermeable to others. This argument is strengthened by a study of the rates of diffusion of various ions through aluminum hydroxide and it is thought that the theory is confirmed by experiments performed on a platinum anode covered with a film of aluminum hydroxide, as this behaves in practically the same way as the aluminum electrode.—*Electrician* (London), November 28.

The Helena Fire.

This is an able editorial discussion of the Helena (Mont.) fire, referred to in the ELECTRICAL REVIEW of December 6. The cause and results of the fire are reviewed at length. A tarpaulin which had been stretched above the switchboard to prevent drippings of tar from the composition roof falling upon the electrical apparatus sagged down and came into contact with the high-tension lightning arresters. This took fire, and in a few moments the whole building was wrapped in flames. The following are the conclusions arrived at from the study of this accident: Original purchase prices, if not of recent date, form no criterion for the estimate of loss and damage. Factors of depreciation and appreciation are more liable to sudden change and are less readily foreseen in electrical work than in any other industrial apparatus. Large oil-insulated station transformers and regulators, when properly installed in substantial cases and mounted on solid foundations, are far more immune from injury by fire than any other kind of electrical machinery. Induction motors are probably a better risk than any other class of movable electrical machinery. Rotary converters inherently possess features which warrant their being classed as less desirable risks than any other class of movable electrical machinery. Oil-insulated, high-tension apparatus, and especially high-tension switching and lightning arrester apparatus, should be installed in a separate fireproof building.—*Journal of Electricity, Power and Gas* (San Francisco), December.

An Alternating-Current Model.

This is a description of a very simple model for illustrating the phenomena of alternating-current circuits. A light wooden rod, carefully balanced, represents by its motion the flow of current. This swings on knife edges, and is moved by hand through a light rod which is attached to the current rod by a small bell crank. One end of this bell crank is extended to act as a pointer, and by its motion indicates the direction and phase of the force acting upon the current rod. To represent friction a short rod clamped over a horizontal axle is attached to the current rod. The friction of this on its axle corresponds to the electrical resistances of a circuit. Inductance is represented by a rod balanced on knife edges and weighted. This is attached to the current rod through a bell crank which indicates the phase of the reactions brought in by this weighted rod. Capacity is represented by a stretched rubber band attached to the current rod through a bell crank and which tends to hold the rod in a horizontal position. When an alternating force is applied to the current rod by hand, the reactions taking place in the circuit are indicated by the various bell cranks attached to the different elements of the model. To secure an approximately harmonic force the rod through which motion is applied is attached to a wooden strip which acts as a spring. By changing the friction of the resistance arm, the weight of the inductance lever, and the tension of the capacity spring, circuits having different constants can be represented. Each change of phase is indicated by the motion of the various bell cranks. The model is easily constructed and should be very useful in explaining the phenomena of alternating currents to students in elementary classes.—*Physical Review* (New York), November.

A Method of Determining the Efficiency of Motors.

Many methods have been suggested for testing dynamos for efficiency by which the measurement of mechanical quantities can be avoided. In this article, Mr. J. R. Ashworth describes a method which was suggested by him in 1893. It was proposed to run a machine at a velocity a little higher than the speed at which the efficiency was required, and while it was yielding the full output to cut off promptly the driving power and to determine the rate of change of speed of the armature as it slowed down past the given speed. Knowing the moment of inertia of the armature and the rate of change of angular velocity, the power required to maintain the armature in rotation can be computed. When this method was first proposed the types of machines being constructed at that time did not lend themselves readily to this method of analysis. Now that the tendency of modern design is to construct the armature on the model of a flywheel it is not unlikely that this method might be used successfully. Methods are given for determining the moment of inertia. The author then takes up the theory, deducing equations for the input of a machine as determined in this way. He then gives the results of a test of this kind as applied to a dynamo. For the sake of comparison an independent set of observations was taken for determining the losses of the machine when unloaded. The method used was that due to Swinburne. A comparison of the results obtained by the two methods shows good agreement.—*Electrical Review* (London), November 28.

Electromagnetic Brakes.

This article gives a somewhat detailed description of a new form of an old type of electric brake for testing small motors. After a brief description of the many types of brake which have been devised for this purpose the author passes to the one in question. This consists of a copper disc fastened to the shaft of the motor to be tested by an adjustable coupling, the latter enabling the disc to be attached to shafts varying considerably in size. The copper disc carried on this coupling revolves between the armature and poles of an electromagnet of the horseshoe type, the coupling passing through an opening in the armature, but not being in contact with the latter. The magnet is supported on knife edges and by means of a stand which enables the mechanism to be accurately leveled. To the magnet is attached, by a vertical rod, a weight which serves to adjust the centre of gravity of the system and in this way alter the sensibility of the machine. To the magnet is also attached a horizontal rod upon which slide weights. These are used to balance the turning effort produced by the motion of the copper disc in the field set up by the magnet. Exciting current is supplied to the magnet by means of flexible wires. A long pointer attached to the magnet indicates when the latter has been brought back to the horizontal position. The power absorbed by this brake can be varied by changing the exciting current or by using discs of varying thicknesses. This construction enables readings to be obtained accurately and quickly so that no provision is necessary for cooling the disc. It is stated that this brake has been used successfully for motors as large as three horse-power.—*Elektrotechnischer Anzeiger* (Berlin), November 20.

The "Crewe" System of Railway Signaling.

This article contains a very detailed description of the electromagnetic system of signaling as now being experimented with by the Northwestern Railway, at Crewe, England. A general description of this system was given in the ELECTRICAL REVIEW for December 13, but a few details of the operating mechanism may be interesting. The signaling station contains sixty levers which occupy but about one-third the space of that required for an ordinary apparatus. The levers are arranged in two tiers, the upper, in general, being used for the signals, while the lower tier is reserved for the operating switches. The motor used in throwing the switches takes about twenty amperes at 100 volts and runs at a speed of about 800 revolutions per minute, enabling the switch to be moved over in three seconds. The armature is formed on a tube which fits over the armature shaft, and it can be lifted off and a new armature substituted in a few moments. The armature shaft is provided with ball bearings and drives a worm and worm-wheel. The worm-wheel is loose on a cross-shaft, and its movement is transmitted to the cross-shaft by means of two clutches. When the switch has been moved over and bolted a striking gear disengages the clutch and the motor then runs free until it stops. Keyed to the cross-shaft is a cam-wheel, on each face of which is formed a cam-shaped slot of irregular contour. In each slot there works a roller attached to a bell-crank. One of these bell-cranks operates the switch and the other the locking bar and bolt. The motor and its mechanism are placed in a cast-iron box with a cover which is level with top surface of the sleepers. The box is filled with mineral oil to the level of the cross-shaft. The motor is placed with its armature in a vertical position and above the cross-shaft. Power is supplied to the motor by a four-core cable about three-fourths of an inch in diameter, laid in grooved timbers and covered with pitch, or in some cases carried overhead. The switch, by means of which the current is supplied to the motor, has carbon contacts which are in duplicate to ensure a good contact. Special connections enable this switch to be taken out and another substituted in a few seconds. The electromagnet used in operating automatically the signals takes a current of about six amperes at 100 volts. This is required for but a few seconds when the current is reduced to two amperes which is sufficient to hold the signal in position. Details of this magnet are not given, but it appears to consist of a coil and plunger movement working in a vertical direction.—*Electrical Review* (London), November 28.

The Northern California Power Company's Transmission.

The district covered by the Northern California Power Company's transmission lines extends from Iron Mountain on the north and Bully Hill from the northeast, to Willows on the south. The demand for power in this territory is constantly increasing. Substations for the distribution of current at reduced voltage are located at many points where current for lighting is being generally used. A good deal of power is contracted for by several of the mines in that locality. The generating station is located at Volta. Mill Seat Creek, the source of water supply for the plant, rises from springs, and for this reason its flow is constant throughout the year, the supply being more than sufficient to develop 3,000 horse-power at the lowest stage. However, the transmission company has secured rights to an amount of water in Galpin, Berry and Battle creeks, which can be diverted into Mill Creek and will triple the capacity of their present plant. Water is carried to the plant by a stave pipe and lap-welded steel pipe thirty inches in diameter. The head is 1,200 feet. Automatic air relief valves are provided at six points along the pipe line where the slope of the ground changes suddenly. The generating equipment is made up of three main units, each consisting of one 750-kilowatt, three-phase Westinghouse generator flexibly coupled to a 1,500-horse-power Pelton wheel. The units are so placed that each generator may be coupled to either of two water-wheels. Water is led to the wheels through a ball and socket-deflecting nozzle, operating on four-inch steel trunnion bolts in oil, packed with gun metal. The nozzle is provided with an assortment of tips, which are interchangeable for the purpose of regulating the flow of water. Each nozzle is controlled by a Lombard governor. The exciting units consists each of an eighteen-inch Pelton wheel mounted on the overhang end of the shaft of a twenty-two and one-half-kilowatt Westinghouse exciter, running at 975 revolutions per minute. The line consists of two three-phase circuits of No. 4 B. & S. gauge bare copper wire. Thirty-foot, eight-inch top, round cedar poles are used in the country, and thirty-five and forty-foot sawed redwood poles in the towns. Forty-thousand-volt glass insulators are mounted upon one and one-half by twelve-inch eucalyptus pins, supported by three and three-quarter-inch by four and three-quarter-inch Oregon pine cross-arms. Current is supplied to the line through ten 350-kilowatt transformers in sets of three each, and one reserve. Here the voltage is raised from 500 to 22,000 for the line. The Northern California Power Company is now installing another power-house, water for which is supplied by Cow Creek. Here 3,000 horse-power will be developed, the units consisting of two 1,500-kilowatt Westinghouse rotating field generators, each to be directly coupled to a Pelton water-wheel. The head of water at the wheels will be about 1,200 feet.—*Journal of Electricity, Power and Gas* (San Francisco), December.

INDUSTRIAL SECTION.

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS.

A Direct-Connected Motor-Driven Grinder.

The accompanying illustration shows a direct-connected, motor-driven wet drill grinder. The drill-grinding features of this apparatus are the same as the belt-driven grinders manufactured by the Wilmarth & Morman Company, of Grand Rapids, Mich. This apparatus is well known, and a description of the electrical features only will be given here.

The maker has endeavored to design a machine as nearly perfect as possible, and has embodied in it every feature that adds to its utility and durability. Capacity is from one-quarter to three and one-half-inch drills, and the net weight of the machine is 505 pounds.

The motor is of the compound-wound type, enclosed in a dust-proof case, driving the emery-wheel directly without the intervention of belts. The standing box is conveniently located in the column of the machine. Water is supplied to the wheel by a centrifugal pump, and the whole grinding face is flooded with water so that there is little possibility of drawing the temper on a drill even when grinding heavily. The water is run through a pipe leading from the lower end of the wheel-hood, and a rubber tube connected to the back end of the holder takes care of the small amount that trickles down the bottom of the "V."

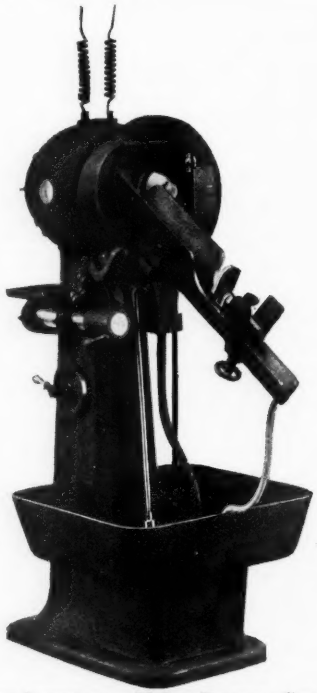
The returning water first enters a settling space where the heavy grindings remain, so that when reaching the pump the water is clear again.

There are no bearings of any kind under water or in any way exposed to the wet and grit, so that though the machine is a wet grinder, the life of the apparatus is not thereby shortened.

The manufacturer states that this style "N" and the motor-driven drill-grinder, style "T," are the only two drill-grinders made that are direct-connected—that is, with a motor on the same shaft as the emery-wheel.

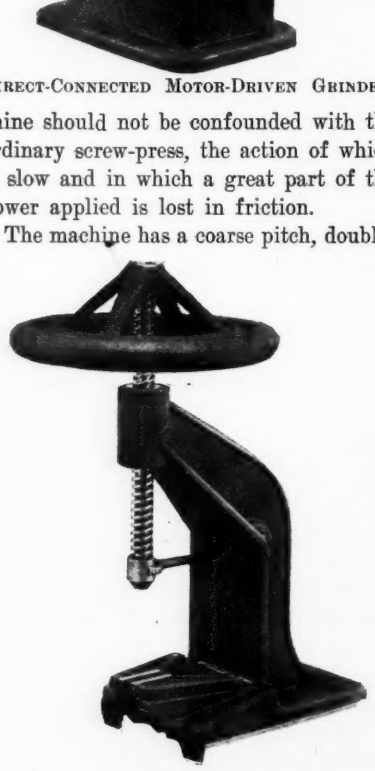
A large number of these machines are in the navy yards and other shops of the United States Government, and also in most of the up-to-date manufacturing shops of the country.

The new "Yankee" arbor and straightening-press for driving lathe arbors and for straightening work is also shown in the accompanying illustration. This machine is claimed to have special features which differentiate it from the ordinary apparatus of this kind, and which make it very satisfactory in service. The machine should not be confounded with the ordinary screw-press, the action of which is slow and in which a great part of the power applied is lost in friction.



DIRECT-CONNECTED MOTOR-DRIVEN GRINDER.

The machine has a coarse pitch, double-thread, screw and a hand-wheel with a heavy rim, the inertia of which is utilized to force the arbor tightly into the work-bore. By the use of this combination, as great a driving effect is produced as with a sledge, but without any battering or injury to the ends and centres of the mandrels.



ARBOR AND STRAIGHTENING PRESS.

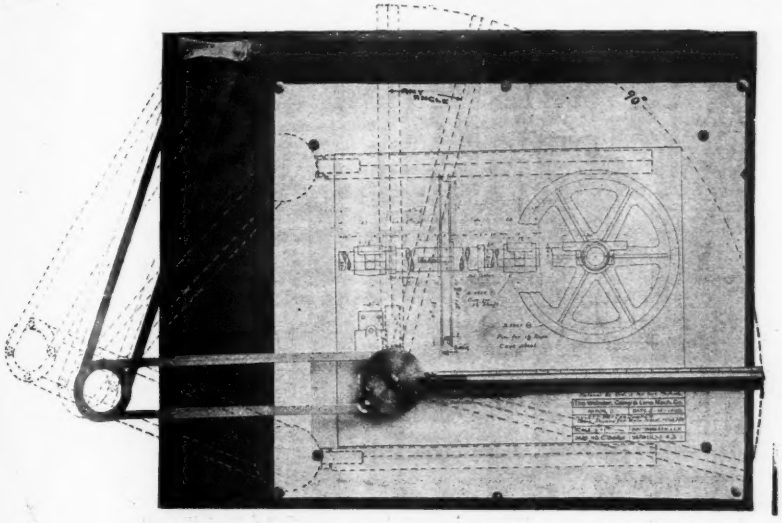
The inertia of the hand-wheel is made use of for giving the arbor two or three final impulses after it has been forced down as far as can easily be done by turning the wheel in the ordinary manner, the ratio being 47 to 1. The thread is of so coarse a pitch that the screw will never lock on the work, and when turned down quickly on a tight-fitting mandrel, it will be repelled and turned in the opposite direction. Its action is much quicker and it requires less exertion to operate than an ordinary screw-press. The arrangement of the jaws on the anvil to accommodate different diameters of mandrels is an excellent feature. These open and close in unison so that the work is always central under the screw and arbors, and can be readily forced in and out of thin bushings. To straighten shafts, etc., the jaws are opened some distance and the pressure applied centrally between. With one hand on the work and the other at the hand-wheel, the rim may be brought down with an easily gauged force and the work quickly straightened, almost always without leaving a mark on it. For light work of this kind alone, the press would have a practical value in a great many installations.

Hard-wood strips are inserted in the bottom so that when bolted to a lathe-bed no damage will be done to the ways, and lugs keep the press forward to prevent the arbors marring the front edge. The machine is equally adapted to be bolted to a bench.

A Universal Draughting Machine and Rapid Sketching Device.

The accompanying illustrations give a good idea of a new apparatus which has been placed on the market with a view toward facilitating the engineers' and draughtsmen's work, both in design and detail. First, by doing the drudgery part of the hand work, and second, by doing the same for the mind and leaving it free for more attention to the betterment of the work in hand. As may be seen from the illustration, the draughting machine consists of a graduated square having an accurate parallel motion to the drawing board. The square is adopted, because

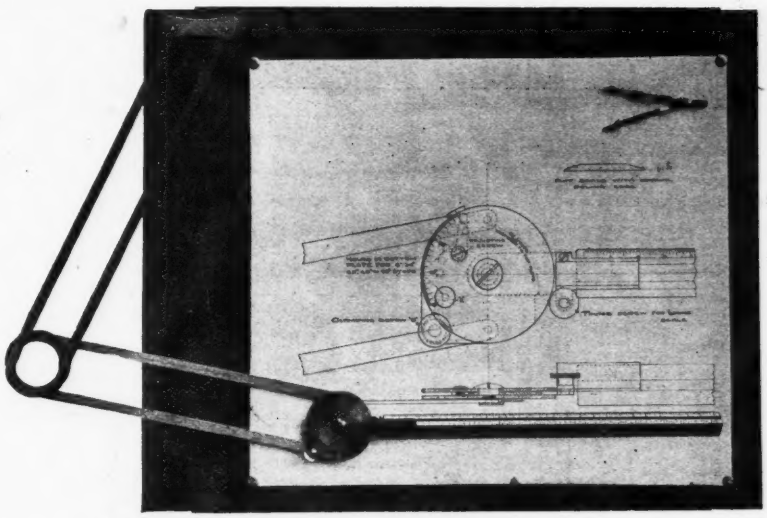
the work in most drawings consists of sets of lines at right angles. Both blades of the square are scaled for drawing and measuring lines at the same time. The plates of the square chuck into place and are interchangeable. Any length and any scale may be fitted to the apparatus. A straight edge is provided for inking, and this may also be used for long lines. This, however, is not necessary, as lines may be quickly and accurately extended with the square. The parallel motion is obtained by means of two pivoted parallelograms which constitute the arm joining the square to the board. This arm is made flexible, allowing the plates to lie flat upon the drawing. It is hinged at the connection to the board and may be easily lifted out of the way of the paper. It may be readily changed from one board to another. A conveniently adjusted protractor makes the machine universal, allowing the square to be quickly set at any angle. This makes all angular work just as easy, as rapid, and as accurate as straight work. Spring stops at thirty degrees, forty-five degrees and sixty degrees are provided, allowing the square to be instantly set at these frequent angles.



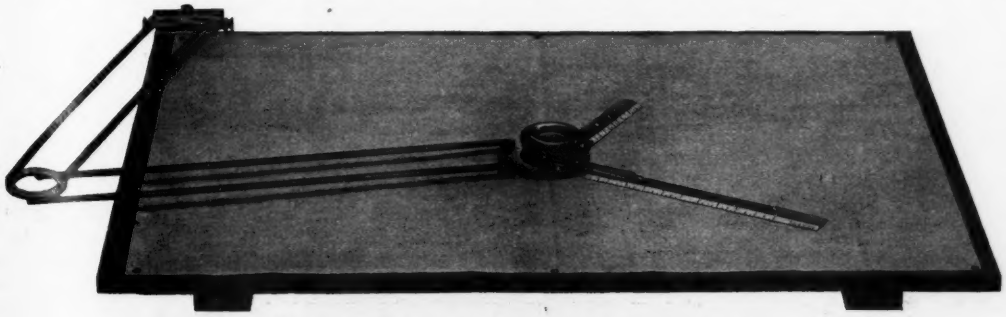
UNIVERSAL DRAUGHTING DEVICE WITH PROTRACTOR.

In using the machine, the operation is essentially as follows: The lines are drawn and scaled with the same edge at the same time. This saves a change of tools, which is necessary with the ordinary scale and "T" square. The angular work is made easy, as a square may be adjusted to any obliquity, clamped at this point, and in this position moved to any part of the board, it always running parallel to itself so long as one adjustment is kept. These two functions of the machine save considerable time, as would be very evident to any one who has done any considerable draughting of a more or less complicated nature.

The rapid sketching device consists of a scale joined to a protractor, which is anchored to the upper left-hand corner of the board by means of an arm made up of two pivoted parallelograms. The scale has a free motion of ninety degrees between stops, and it goes against either one or the other, depending on whether a horizontal line or a vertical line is desired. These two stops are fastened to a protractor and may be turned to any angle with the horizontal or vertical, thus permitting the scale to come against the stop at a desired angle and also at right angles to it. The lower part of the protractor always lies in the same direction, no matter where it is moved about the board, and hence when the protractor is once set at any desired angle the scale will give parallel lines anywhere on the drawing.



UNIVERSAL DRAUGHTING DEVICE FOR SCALING AND STRAIGHT LINES.



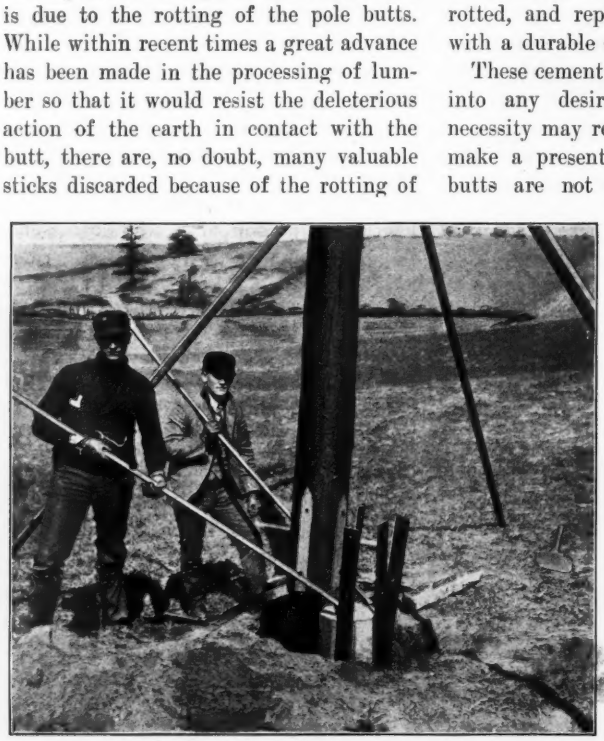
RAPID SKETCHING DEVICE FOR ANGULAR OR SQUARE DRAWING.

This is claimed to be very useful for any one having sketches or small drawings to make, such as pulleys, gears, shafts, levers, forges, valves and general architectural detail, structural detail or mechanical detail.

These sketching devices are manufactured by the Universal Draughting Machine Company, Blackstone Building, Cleveland, Ohio.

Durable Cement Butts.

Probably one of the greatest factors in the depreciation of pole line construction is due to the rotting of the pole butts. While within recent times a great advance has been made in the processing of lumber so that it would resist the deleterious action of the earth in contact with the butt, there are, no doubt, many valuable sticks discarded because of the rotting of the butt and the consequent shortening of the pole, making it unfit for construction work on transmission lines.

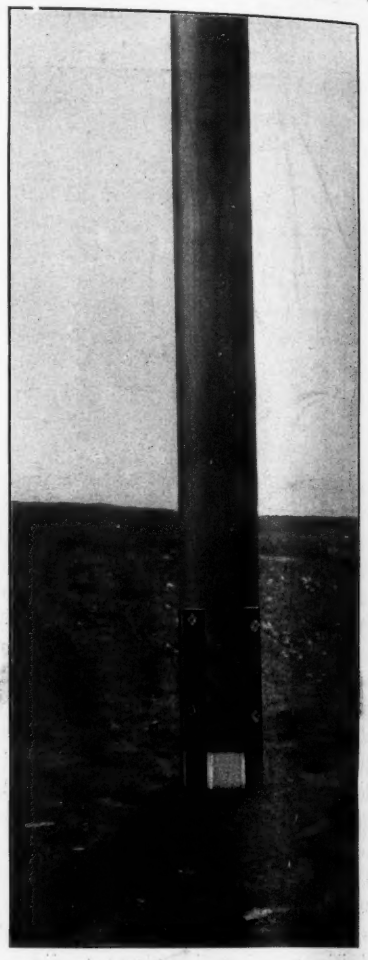


PLACING A RESTORED POLE UPON NEW CEMENT BUTT, WITHOUT INTERFERING WITH OVERHEAD WIRES.

The accompanying illustrations will give a good idea of a new form of construction which, its manufacturer claims, will entirely restore to first-class condition any pole which may have rotted at the butt, and render the rotting of new poles impossible. This consists in sawing off the butt of a pole which may have rotted, and replacing the rotted portion with a durable cement butt.

These cement butts are cast or moulded into any desired shape or length, as necessity may require. If it is desired to make a present line higher, and if the butts are not thoroughly decayed, the poles may be simply raised by setting these durable cement butts beneath them in the old holes.

The connection of these cement butts to the poles is very simple. If the butt is to be connected to a new pole, the pole is simply scored to receive the iron straps, of which there are four, and the cement butt brought into contact with the end of the pole. The butt is then securely fastened to the pole by means of these iron straps by passing bolts through and making the proper connections. When it is necessary to fit a butt to a standing pole, the pole is first sawed off square and holes are bored to correspond with the holes in the side straps. The pole is scored to fit between the side arms, and then the pole is slid off the rotten butt. The old butt is taken out of the ground and the cement butt placed in the hole. The cement butt is allowed to project at least six or eight inches above the ground,



A POLE MOUNTED UPON A NEW CEMENT BUTT.

the iron nearest the pole is pulled aside, and the pole slid on to the cement butt. The bolts are then driven in firmly and the nuts tightened up on the straps, when the hole is filled in and the earth tamped, as is usual with the ordinary construction. The accompanying engraving shows the operation of sliding the old pole on to the cement butt, and the finished appearance of the old pole standing on the new butt. This operation has been performed entire in twenty minutes, without in any way interfering with the overhead construction. The illustration also shows the adjusting boring machine which adjusts the boring apparatus so that the pole can be bored clean through correctly, in order that all bolt holes will correspond to the holes in the side irons. These cement butts are not only of great value for use in pole line construction, but for fence work of every description they can be used in the different shapes in which they are made. These butts are manufactured by the Durable Cement Post Company, Battle Creek, Mich.

ADJUSTABLE APPARATUS FOR ALIGNING BOLT HOLES.

Group of Telephone Men at Interstate Convention.

One of the features of the recent convention of the Interstate Independent Telephone Association, at Chicago, was the enthusiasm with which all the delegates entered into the spirit of each occasion.

On receipt of an invitation from one of the prominent artists of the city, the attendants gathered in the large group here shown and were photographed.

Many prominent members of independent telephone interests may be readily recognized, and this group will, no doubt, become historic as being typical of the solidity and stability of both organization and progress in the nine states of the association.

Another very interesting photograph was one taken during the banquet. This was one of the most enjoyable events which took place during the visit of the telephone men to Chicago.

A Group of Attendants at the Interstate Independent Telephone Association Convention, Chicago, December 9, 10 and 11, 1902.

Central power distribution schemes will undoubtedly prevail in the future of electrical engineering in England. The Cheshire, Staffordshire and Derbyshire power bill is the latest move in this connection, and promises to be a preeminently successful undertaking. Generating stations are to be erected in the neighborhood of Frodsham (seven acres), Sutton (thirteen acres), and Stone (eleven and one-half acres), and it is within the bounds of possibility that the Liverpool to Manchester monorail scheme will ultimately derive its power from this source.

St. Louis Exposition Officials in the East—Dinner at the Lotos Club.

A number of the head officials of the St. Louis Exposition have been in the East during the past week. Among other places visited were the extensive works of the Westinghouse companies' interests at Pittsburg, and the subway and large electric power and lighting stations in New York city. Every courtesy was extended to the St. Louis gentlemen by the officials of the various companies visited, and they greatly enjoyed their inspection of these modern electrical equipments.

On Friday evening, December 12, the visitors were entertained at dinner at the Lotos Club by W. M. Probasco and Charles A. Terry, of New York. Among those in attendance were ex-Governor David R. Francis, president of the Louisiana Purchase Exposition; Henry Rustin, chairman of the mechanical and electrical engineering department; Isaac S. Taylor, director of works; J. E. Smith, exposition director; the Hon. Rolla Wells, Mayor of St. Louis; ex-Senator Thomas Carter, commissioner; Melville E. Stone, general manager Associated Press; Walter C. Kerr, Calvin W. Rice, Charles A. Bragg, L. D. Dozier, J. C. Thompson, Calvert Townley, G. Pantaleoni and F. S. Smith. The dinner was a very enjoyable affair, and a number of informal addresses were made relating to the fine prospects of the coming exposition of 1904 and the growing interest in it shown by the East.

Tenders for British Railways.

The tenders for the electrification of the Northeastern Railway, which were advertised for some time back, are now in the hands of the directors of the company, who will, however, take some time to consider them. On the subject of electric traction it is to be noted that the accelerated system on the Liverpool Overhead Railway, consequent on the introduction of the new trains recently mentioned, has attracted the attention of several of the managers of our standard steam lines who have been paying a visit to Liverpool to inspect the new trains. One of these days one may expect to see these same managers take the question of electric traction seriously. At present the majority treat it with a scepticism characteristic of the eighties. Still on the same subject, a rumor comes from Germany that a bill is to be introduced into our Parliament next session for the introduction of the Langen suspended railway upon a piece of line ten miles long, the locality of which, however, is not mentioned. Speaking of suspended railways reminds me that the promoters of the Liverpool-Manchester line are not finding things going any too smoothly with them. The Board of Trade has declined to pass the plans of the complete railway until it has had an opportunity of inspecting a portion in actual operation. It has therefore been decided that a length of a few miles of experimental track shall be constructed for this purpose.

A. W.

London, December 6.

A New Steam Turbine.

In recent years remarkable results have been secured through the use of various types of steam turbines, and many engineers are looking forward to the day when this type of prime mover will be largely used in electric light and power stations. It is therefore interesting to follow the developments going on in this line of engineering, and to study the lines along which inventors are working.

A recent type of steam turbine which, it is asserted, has given some remarkable results consists of sets of discs, arranged in pairs. Each pair consists of two discs having projecting rings concentric with the centre of the disc, the inner surfaces of which are fashioned to form pockets into which the steam is led, and from which the steam escapes by a suitable outlet. The projecting rings of these discs fit into one another. One of these discs is shown in Fig. 1.

Steam is led into this turbine through a hollow shaft. From here it passes

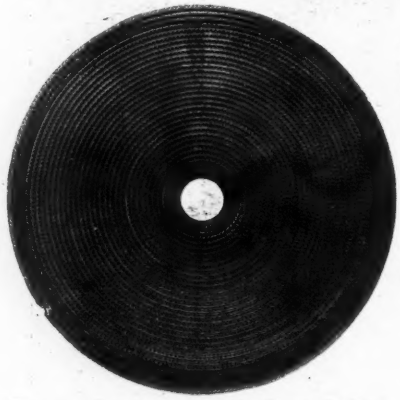


FIG. 1.—ONE OF THE DISCS USED IN NEW TYPE OF TURBINE.

through radial openings into the pockets of the inmost rings of each pair of discs. Expanding in this pocket or chamber, it passes through the outlet and impinges upon the opposing surfaces of the pockets of the next ring, this ring being one of the other of that pair of discs. Expanding again here, the steam passes to the next series of pockets, and thus continues until it reaches the periphery of the wheel. An examination of the cut shows that in its passage from ring to ring the steam meets an increased number of pockets, and therefore an increased volume, allowing for complete expansion. The reactions of the steam in its zig-zag passage from ring to ring will tend to drive the two discs in opposite directions. To permit this to take place, one disc is attached to the hollow shaft, and the other, by its outer rim through a shell, to a sleeve turning on the shaft. Each disc is then free to turn, and the power developed by the two is transmitted by means of bevel gears to the apparatus to be driven.

As many pairs of these discs as are desired may be mounted on the same shafts and the power of the turbine increased in this way. In Fig. 2 are shown the parts of one of these turbines before assembling, and in Fig. 3 is shown the turbine complete with upper half of casing removed.

Many advantages are claimed for this turbine. The steam, in its passage from the centre outward, expands continuously, and thus at no moment does it come in contact with metal which is cooler than itself. In fact, due to the conductivity of the metal, this will be at a higher temperature than the steam in contact with it, so that there is a tendency to reheat the steam. By a proper design of the chambers, the steam can be taken in at any pressure and expanded down to that of the atmosphere. There are no moving valves of any kind, and since there are no rubbing parts except the journals, no lubrication of other parts is necessary. The turbine can be built to run at various speeds and can be directly connected if so desired. Since there are two parts of the turbine revolving in opposite directions, this feature may be used to revolve in opposite direction the field and armature of a dynamo, giving a relatively high speed between the two parts.

The inventor of this turbine, Mr. John F. Brady, has built a turbine of this description thirty-seven inches in diameter and six inches in width. This turbine has been tested at the shops of the John F. Brady Turbine Company, Chicago, Ill., and with a steam inlet pipe one-half inch in diameter and the steam at 200 pounds pressure, the output of the machine, it is stated, was ninety horse-power. Profiting from the experience gained from the test of this machine, the company is now building a turbine of this description which will be ten feet in diameter and eighteen inches wide. The speed of this will be 215 revolutions per minute, and the company expects this turbine to develop 2,500 horse-power with an inlet pipe of one inch in diameter and steam at 200 pounds pressure.

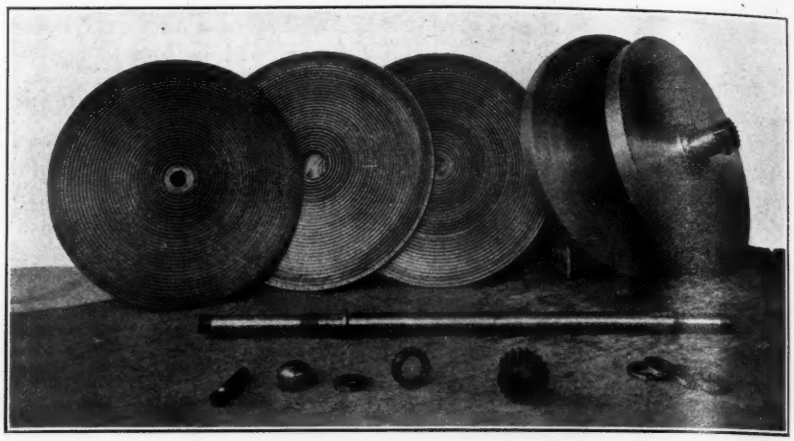


FIG. 2.—THE PARTS OF THE TURBINE BEFORE ASSEMBLING.

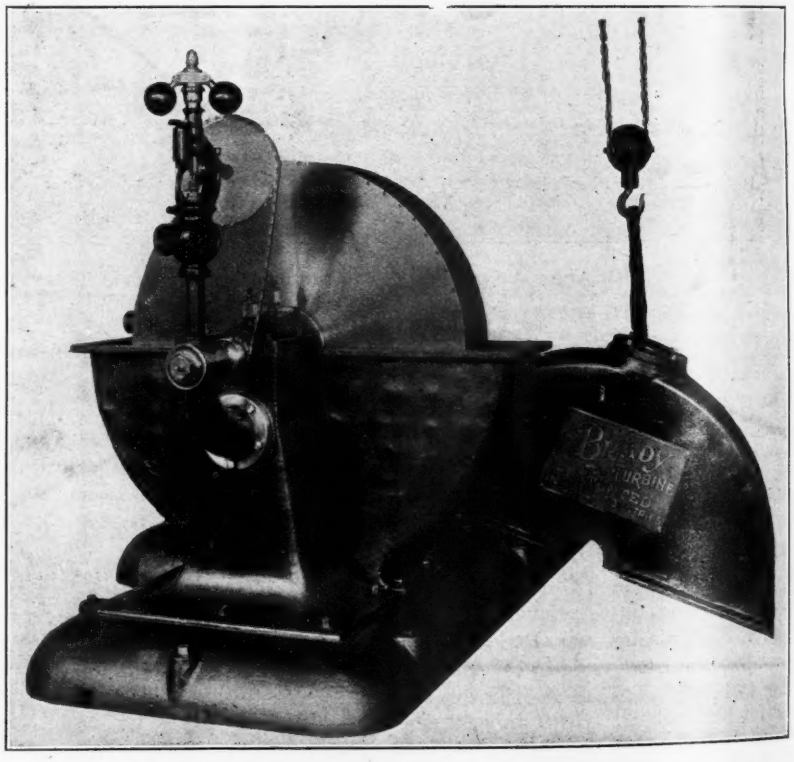


FIG. 3.—TURBINE COMPLETELY ASSEMBLED—UPPER PART OF CASING REMOVED.

CURRENT ELECTRICAL NEWS

DOMESTIC AND EXPORT.

NEW ALABAMA WATER POWER—After thirty days' test of the electric current from the water power at Tallassee, Ala., on the Talapoosa River, about thirty-five miles from Montgomery, the consolidation of the Montgomery Light and Power Company and the Tallassee Water Power Company has been effected, the new name being the Montgomery Light and Water Power Company. The river can supply 5,000 horse-power and the local steam plant 3,000. The present consumption is about 2,500 horse-power. The new company has issued $1,500,000 stock and the same amount of bonds, the authorized capital being $2,000,000 stock and $3,000,000 bonds.

INDIANAPOLIS TRACTION DEAL—It has been announced that the Indianapolis Traction and Terminal Company is to lease the Indianapolis Street Railway Company's lines for thirty years. If this deal is carried through it is proposed to issue five million dollars of stocks and five million dollars of bonds. Of the stock $1,500,000 will be distributed to the stockholders and the street railway company, and a bonus of a fixed, graduated dividend. All the street railway stock will be guaranteed from the date of the signing of the lease. The Terminal company has a franchise and contracts with all the interurban roads and in a few months will erect a station costing about $1,000,000.

ALASKAN WIRELESS TELEGRAPHY—The wireless telegraphy station at Fort Gibbons in Alaska has been completed, but the company doing the work for the United States Government is unable, it is stated, to proceed further with the contract until a modification of the plans has been effected by the War Department. It has been discovered that the point selected for the second station above Bates Rapids was inaccessible and could not be reached except at an expenditure which made it impracticable to follow this route. Lieutenant Gibbs, who has had charge of the work, has selected another point for the second station and if his plans are approved by the War Department, work will be commenced there again next season.

BIDS FOR LIGHTING GUAYAQUIL—The municipal council of Guayaquil has issued an advertisement inviting tenders for lighting the city by gas or electricity. The tenders must be sent to the secretary of the municipal council of Guayaquil not later than February 12, 1903, under sealed envelope. The lights are to be located 3.8 yards above the surface and 1.9 yards from the front of the houses and are to be not further apart than 38.1 yards. Each light is to be of 15.4 candle-power. At the intersection of the streets near the central part of the city, the lights are to be eighty candle-power, located at a height of 6.5 yards. In all cases the light used in the streets shall be arc lights. The council guarantees that it will take at least 1,400 lights during eleven hours daily; also fifty lights of eighty candle-power. The payments will be made monthly. The conductors must be laid underground and of the most modern size and construction.

NEW TELEPHONE LINE—The Southwestern Telephone and Telegraph Company has in hand a plan for a large extension of its lines in Texas. A new line is to be constructed from Dallas to Kansas City, following the line of the Missouri, Kansas & Texas Railway. According to plans, it will touch Dallas, Durant, McAlester, Vinita, Muskogee, Fort Scott and Kansas City, with direct connection from Dallas to Fort Worth. The line is to be built of extra strong construction, carrying besides local wires four of the largest gauge telephone lines in use. Besides this, the company has started a line from Laredo to San Antonio, along the Southern Pacific, and has three or four hundred miles of line completed in the state. The company is also building a line from San Antonio to Uvalde, and expects next year to carry the line through to Del Rio and Eagle Pass, a distance of 200 miles. At the end of next year it is expected that 6,000 miles of poles will be up, carrying 60,000 miles of wire, in Texas and Arkansas.

THE NILE DAM OPENED—The great engineering project of building a dam on the Nile River at Assouan and Assiout has been formally inspected and announced completed by the Duke of Connaught and the proper officials. This is a dam and navigation channel at Assouan, a barrage and lock at Assiout, and a regulator and lock at the head of the Ibrahimieh Canal at Assiout. The dam is across the first rapids of the first cataract, to the north of the Island of Philae, and the height to which the water is to rise has been so adjusted that the ancient temples on this island will be entirely submerged. The dam is to hold up water 106 metres above mean sea level, and the greatest head on the dam will be twenty metres, the lowest level on the downstream side being eighty-six metres. The storage capacity is estimated at 1,065,000,000 cubic metres of water. The reservoir will be filled between December and March, after the flood has passed, and will be discharged during May, June and July. There are 140 under sluices fourteen square metres in area, and forty upper sluices, seven square metres in area. The dam is straight from end to end, and its length is about 2,000 metres. Its width at the top is seven metres, and at the deepest part, twenty-five metres. A navigation canal has been constructed, which has already been opened, whereby navigation has been rendered possible throughout the year as far as Wady Halfa. The canal is provided with four locks, each seventy metres long and nine and one-half metres wide, the height of their gates graduating from nineteen down to eleven metres. The machinery for operating the sluice gates and locks will be moved by electric power.

ELECTRIC RAILWAYS.

UTICA, N. Y.—The Oneida Railway Company has been granted a franchise in the village of Canastota.

DANVILLE, PA.—It is stated that the Columbia & Montour Electric Railway Company will build a trolley line between Danville and Bloomsburg the coming year.

BEAVER DAM, WIS.—A fifty-year franchise for an electric road has been granted by the common council to the Madison & Northeastern Railway Company.

DEFIANCE, OHIO—A franchise has been granted to J. Morgan, trustee of the People's Rapid Transit Company, the interurban line proposed from Toledo to this city and south.

WILLIAMSPORT, PA.—Work on the trolley line between Jersey Shore and Oak Grove is being pushed rapidly forward, and the company hopes to have the line in operation by January.

SYRACUSE, N. Y.—It is reported that Charles A. Sweet, of this place, has completed a survey for a trolley road from Sylvan Beach to Rome, by way of Stacy Basin and New London. It is intended to have the road completed by July 1, 1903.

SHEBOYGAN, WIS.—The city council has extended the franchise limit of the Sheboygan-Elkhart Lake Electric Railway Company from December 1, 1902, to September 1, 1903, at which time the company agrees to have the line in operation.

GLENS FALLS, N. Y.—Work has been begun on the Manchester, Dorset & Granville Railroad. The road will be twenty-two miles in length and will connect with the Rutland Railroad at Manchester and with the Delaware & Hudson Road at Granville.

LANSING, MICH.—The Michigan Central Traction Company has been granted a franchise by the Lansing council for an electric line between Battle Creek and Lansing. The franchise provides that the road shall be in operation by next September.

HACKETTSTOWN, N. J.—The Lopotcong township committee has adopted an ordinance granting a franchise to the Easton & Washington Traction Company to build its line over about four miles of the turnpike, from the limits of Phillipsburg to the road leading to Stewartsville.

NEWPORT, PA.—The Perry County Electric Street Railway Company, whose line runs from Marysville to Duncannon, has resolved to extend its line from Marysville to Shermansdale, *via* Key-

stone and Grier's Point, and to intersect at Shermansdale with the Cumberland & Perry Street Ra lway Company.

BALTIMORE, MD.—The Annapolis, Washington & Baltimore Railroad has been bought by interests which are constructing an electric line between Baltimore, Annapolis and Washington, under the name of the Washington, Baltimore & Annapolis Electric Railway Company. The price paid is said to be near $300,000.

VERSAILLES, IND.—The town council of Versailles has been asked by the Southern Indiana Railway Company for a franchise through the streets of the town. The company proposes to build an electric line from Aurora west to Dillsboro, Versailles, Osgood, and connect with the Indianapolis line at Greensburg.

MOUNT HOLLY, PA.—The People's Traction Company has made application for franchises to construct roads between Mount Holly and Burlington, and Mount Holly and Smithville, the former a distance of seven miles and the latter two miles. The matter is to be considered at a special meeting to be held December 20.

SIDNEY, N. Y.—It is now stated that the electric road to Franklin will be built in the spring, the necessary money having been raised. It is estimated that the cost of construction, including power-house, etc., will be $200,000. The distance between the two places is fifteen miles, and it is possible that the road may be extended to Treadwell, seven miles beyond Franklin. The chief business of the company will be freight hauling, the road to be built so that cars can be taken off the steam roads to Franklin for loading and unloading.

LA FAYETTE, IND.—The Indianapolis, Lebanon & Frankfort Traction Company has been granted a franchise to build interurban railways in Tippecanoe County. The company is to build a road beginning at Indianapolis and running through Augusta, Zionsville, Whitestown, Lebanon, Frankfort, Mulberry, Dayton and La Fayette. The road is already bonded to the amount of $3,000,000, and the company promises to have the line in operation by December, 1902. The company will shortly change its name to that of the Indianapolis & Northwestern Traction Company.

CLEVELAND, OHIO—The Lorain & Eastern Railway Company has been incorporated at Columbus by Cleveland and Lorain capitalists, who announce that they will build a new line from Rocky River to Lorain and Elyria. The company has a nominal capital of $1,000, which will later be increased to the requisite amount. The incorporators are: A. B. Stuber, William D. Young, George L. Cooley, D. T. Miller, Frank R. Lander, Henry W. Stecker. The company will have its own right of way the entire distance, and states that everything is in readiness to go ahead with the line.

KALAMAZOO, MICH.—A company has been organized in this city for the purpose of constructing an electric line in South Haven, with branches running both north and south from that city. One line will run three miles north along the lake shore, and the other will extend three miles south along the banks of Lake Michigan, and then diverge eastward to Paw Paw Lake. The company has a paid in capital of $75,000. The stockholders are: Samuel S. Dunkley, W. S. Dewing, both of this city; George Bardeen, of Otsego; G. J. Monroe, M. Hale, C. H. Williams, all of South Haven; Norton Brothers, of Chicago, and G. W. Merriman, of Hartford. A franchise has been granted to the company in South Haven, giving it permission to use the streets, and rights have been secured to run the line to Paw Paw Lake.

MARION, IND.—John P. McGeath, of Hartford City, and W. M. Amsden and W. J. Houch, of Marion, have been granted a franchise by the Grant County commissioners for the use of certain highways for the construction of an electric railway to extend from Hartford City through New Cumberland, Matthews and Fowlerton to Fairmount. The company is to be incorporated under the title of the Oil Belt Traction Company. The term of the franchise is fifty years and the road is to be completed and in operation by December 1, 1904. It is the intention of the company to secure private right of way as far as possible, and when this is secured the work of building the road will go rapidly forward. While the new company is to be independent, it will connect at each end with other electric railways—the Union Traction Company, of Indiana, at Fairmount, and at Hartford City with two interurban lines, one of which is already constructed between Hartford City and Muncie.

TELEPHONE AND TELEGRAPH.

WATKINS, N. Y.—The Interocean Telephone and Telegraph Company has commenced the construction of a line from this village which is to connect with Ithaca direct. The work is to be pushed to completion at once.

NUNDA, N. Y.—The Business Men's Telephone Company has been sold to the Ricker Telephone Company, which runs in connection with the Bell Telephone Company at Fillmore and other places, and to Edward Colgrove and Nathan Colgrove, of Rossburg.

JOHNSTOWN, PA.—The Western Union Telegraph Company, which has recently been at work building connections from Stoyestown through to Altoona, *via* Johnstown, now has the line nearly complete. This line will establish a through service between the two cities.

ALBANY, N. Y.—The Columbia Telephone Company, of Hudson, has filed articles of incorporation with a capital stock of $50,000. The company will operate chiefly in Columbia County. The directors are: B. F. Chase, J. H. Bidwell, R. L. Andrews, R. G. Foster, D. T. Dyer, E. M. Andrews, all of Connecticut, and E. C. Getty, of Hudson.

ELECTRIC LIGHTING.

ALTOONA, PA.—W. H. Mondy has been granted a franchise for an electric light plant at Mount Union, Pa.

SHARON, PA.—The Pittsburg & Conneaut Dock Company will begin at once to install electric power for ore-handling machinery.

GLEN GARDNER, N. J.—This village is to have an electric light plant. The machinery has been ordered and will be installed as soon as possible.

PORT DEPOSIT, MD.—Many improvements will be made to the plant of the Port Deposit Electric Company. New machinery is to be installed, increasing the capacity of the plant twenty-five per cent.

ABERDEEN, MD.—An electric light plant will be established in Aberdeen by January 1, 1903, by a company organized as follows: D. B. Arthur, president; Dorsey Rowe, secretary; L. A. Funk, manager.

INDIANAPOLIS, IND.—L. K. Davis, of this city, has purchased the electric and gas plants at Martinsville, and will at once expend about $50,000 putting in new machinery and improving the present equipment.

BRISTOL, PA.—The Trenton syndicate which recently purchased the stock of the Bristol Electric Light Company has paid the balance of the purchase money and taken possession of the plant. The new officers are: George Shoemaker, president; J. L. Kuser, treasurer; Thomas Scott, secretary.

BOSTON, MASS.—The United Electric Light Company, of Springfield, has been authorized by the gas and electric light commission to issue $107,500 of additional stock, part of which is to be used in paying the floating debt of the company, and part for additions to its underground system.

MEDIA, PA.—The White Clay Creek Supply Company has a force of men at work setting up poles for the new electric light line it intends to build from a point about eight miles below Avondale. The work will be completed in a few weeks, and the line will then be extended to Toughkenamon and Kennett, and later to West Grove.

BROOKLYN, N. Y.—The Brooklyn Rapid Transit Company is to have a modern and thoroughly equipped car building, and work was begun recently on the transformation of the old terminal sheds of the South Brooklyn Railroad and Terminal Company for this purpose. The work will cost about $50,000, and a like amount will be spent in equipping the shop with the necessary tools and fittings.

HYATTSVILLE, MD.—Work on the construction of a new $300,000 power-house for the Washington, Baltimore & Annapolis Electric Railway in East Hyattsville was begun recently, and will be prosecuted vigorously until completion. The engineer in charge of the construction states that he expects the plant to be in operation by October 1 next. The plant will occupy an area of one acre of ground.

ELECTRICAL SECURITIES.

Following the trend of conditions which have obtained in the stock market for the past two weeks, the most significant feature was the extent of liquidation and the expected advance in rates for money. These advanced as high as 12 per cent for call money and 7½ per cent for short-time funds. Securities, as a rule, found declines, and it is a fact that some of the prices have reached the lowest level for any time during the entire year. In spite of this condition, locally, however, the sterling market has held comparatively firm, and this is explained by the fact that many of the banking houses have made further large foreign loans. This means a further increase in the foreign indebtedness and offsets the recent reductions made in this item. The present imbroglio between Venezuela and the allied powers of England and Germany brought about a condition which, for a short time, was very similar to the conditions of 1895, when President Cleveland issued his drastic note with regard to the Monroe Doctrine. While stocks last week did not become as panicky as in 1895, still the coincidence of the dates and of the main features of the affair was viewed in many cases with alarm and distrust. While Venezuela has probably had more than her due time to make the amends necessary, the probability is that political sentiment will not be in commendation of the severe and swift measures which the German representative has visited upon the South American republic. It is extremely likely that in the end the matter will be submitted to arbitration and, if not too late, the good offices of the United States will be recognized in this contingency.

ELECTRICAL SECURITIES FOR THE WEEK ENDING DECEMBER 13.

New York:	*Closing.*
Brooklyn Rapid Transit	61¾
Consolidated Gas	207¼
General Electric	174¼
Kings County Electric	210
Manhattan Elevated	144
Metropolitan Street Railway	137
New York & New Jersey Telephone	162
Westinghouse Manufacturing Company	191

A dividend of $2 per share will be paid on January 15, 1903, to holders of the common stock of the General Electric Company of record at the close of business on Saturday, December 20.

The board of directors of the Western Union Telegraph Company has declared the regular quarterly dividend of 1¼ per cent upon the capital stock of the company, payable at the office of the treasurer on January 15.

Boston:	*Closing.*
American Telephone and Telegraph	158½
Edison Electric Illuminating	265
Massachusetts Electric preferred	93¾
New England Telephone	135
Western Telephone & Telegraph preferred	97

Philadelphia:	*Closing.*
Electric Company of America	9⅛
Electric Storage Battery common	76
Electric Storage Battery preferred	78
Philadelphia Electric	7¾
Union Traction	45⅞
United Gas Improvement	107¼

The directors of the United Gas Improvement Company have declared the regular quarterly dividend of 2 per cent, payable January 15 to stockholders of record December 31, 1902.

Chicago:	*Closing.*
Chicago Edison Light	175
Chicago Telephone	160
Metropolitan Elevated preferred	85
National Carbon common	26
National Carbon preferred	97
Union Traction common	13¾
Union Traction preferred	45

PERSONAL MENTION.

MR. NORMAN MARSHALL, president of the Marshall-Sanders Company, Boston, Mass., was a New York visitor last week.

MR. IRVING B. SMITH, secretary-treasurer of the Wirt Electric Company, of Philadelphia, made a trip through the West last week.

MR. WILLIAM STARK SMITH, secretary and treasurer of the Browning Manufacturing Company, Milwaukee, Wis., was a recent visitor to Boston and New York, returning West on Wednesday of this week.

MR. D. C. HEMINGRAY, secretary of the Hemingray Glass Company, of Covington, Ky., was a Chicago visitor last week. Prior to his departure from home Mr. Hemingray entertained some eastern visitors in true Kentucky style.

SENATOR O. E. HARRISON, Greenville, Ohio, was a visitor to Chicago last week. Senator Harrison is very much interested in the development of the telephone, and was a visitor to the works of the Stromberg-Carlson Telephone Manufacturing Company.

MR. E. J. LAVENS, formerly connected with the General Incandescent Arc Light Company, will assume entire charge of the panel board, switchboard and switch departments of the works of the Bossert Electric Construction Company, Utica, N. Y., on January 1, 1903.

MR. ROBERT L. WARNER, Boston sales manager of the Westinghouse Electric and Manufacturing Company, presented a paper on "Electrically-Driven Shops," illustrated by stereopticon views, at the regular meeting of the New England Railroad Club, in Pierce Hall, Boston, December 9.

MR. B. M. DOWNS, general manager of the Brookfield Glass Company, of New York, returned last week from a very successful tour of the Middle West. The severe Chicago weather did not agree with Mr. Downs and for a day or two kept him confined to the Auditorium with a threatened attack of "la grippe," which, however, did not develop.

MISS ANNA DICKINSON POPE, daughter of the late Franklin Leonard Pope, the well-known electrician, is a member of the staff of the Equitable Life Association with an office at No. 20 East Forty-second street. In her work, Miss Pope will call on the electrical fraternity and will receive a kindly welcome from the great number of friends possessed by her father during his life.

MR. FREDERICK L. BLENDINGER has resigned as superintendent of telegraphy of the Erie & New York, Susquehanna & Western Railroad and will engage in private business in Woburn, Mass. Mr. Blendinger has been connected with the Erie Railroad some twenty-three years and has but recently equipped the Bergen tunnel with an elaborate system of electric signaling apparatus which renders very nearly impossible any chance of collision.

MR. A. FREDERICK COLLINS, who has contributed a great deal recently to the subject of wireless telegraphy and telephony, making many valuable researches in the latter field, has become permanently located at 11 Broadway, New York city. Mr. Collins will give a series of lectures before educational institutions on wireless telegraphy and telephony and color photography. He will also arrange for the presentation of the subject of the navigation of the air by Dr. T. Byard Collins.

DR. FRANZ MEYER has opened an office as consulting metallurgical and chemical engineer at 68 Broad street, New York. Dr. Meyer has had large experience abroad as chief chemist, manager and technical director of a number of works, among which may be mentioned the Actien-Gesellschaft fuer Zink Industrie, Oberhausen-Rhineland, Germany. He will make a specialty of negotiating the sale and purchase of inventions and patents relating to the metallurgical and chemical industries in this country and abroad.

INDUSTRIAL ITEMS.

MR. CHARLES K. HILL has announced his removal to his new offices, rooms 1118 and 1120 Westinghouse Building, Pittsburg, Pa. The warerooms are at River avenue, Allegheny.

THE MARSHALL-SANDERS COMPANY, Boston, Mass., has placed a complete line of all its specialties, sockets, switches, cut-outs, plugs and receptacles with Hall & Company, Monadnock Building, Chicago.

THE D'OLIER ENGINEERING COMPANY, South Eleventh street, Philadelphia, is the eastern agent for the De Laval steam turbines and turbine machinery. This company will be pleased to send attractive literature on request.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., has opened an office in Pittsburg, at 319 Frick Building. This office will be in charge of Mr. C. C. Badeau, formerly with the Wagner Electric Manufacturing Company, of St. Louis.

HALL & HENSHAW, fire underwriters, who are very popular with a great number of electrical interests, have started the season by sending to their patrons a calendar-booklet. This is handsomely bound in Russia leather and is a gilt-edged proposition in every respect.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is placing on the market a new line of power-factor indicators and wattmeters. These are additions to a long line of electrical machinery for which the Wagner company has become famous.

THE CINCINNATI MILLING MACHINE COMPANY, Cincinnati, Ohio, has issued a valuable book for machine tool men. This is entitled "A Treatise on Sharpening and Grinding Milling Cutters, Reamers and Other Tools." This will be sent on application to the company.

THE DAYTON FAN AND MOTOR COMPANY, Dayton, Ohio, has made arrangements with the Diehl Manufacturing Company, whereby it has obtained a perpetual license to manufacture fans which embody the principles covered by the Diehl and Bennett patents.

THE OKONITE COMPANY, New York city, is out with one of the most attractive calendars which have been issued for 1903. The panel is a scene which might have been borrowed from a Delft plaque, and is a dainty color effect of the Holland dikes and windmills, to say nothing of the ladies.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing to the trade a new No. 9 D. & W. price list. This includes half-tone illustrations of all D. & W. products, and contains much new material not heretofore listed. Any prospective buyer can obtain a copy of this book by addressing the company.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., reports gratifying results from its constant-potential alternating arc lamp. This lamp operates on the repulsion principle, and its popularity with central station managers is a tribute to its merit. The company will be pleased to quote prices and information to prospective buyers.

THE JOHN A. ROEBLING'S SONS COMPANY, New York city, manufacturer of wire and wire rope, is in season with a very practical daily memorandum and desk pad for 1903. This comes with the compliments of Mr. Henry L. Shippy, treasurer of the company, and with a hearty greeting of health, happiness and good luck to all of his friends.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Chicago, Ill., and Rochester, N. Y., reports a great many enquiries regarding its new hook switch which has recently been placed upon the market. The company's telephones are being equipped with this new style hook, which was illustrated in the ELECTRICAL REVIEW of last week.

THE AMERICAN TELEPHONE COMPANY, Chicago, Ill., made an elaborate exhibit of large central energy switchboards in the course of construction at its factories during the recent interstate convention. The company received a great many visitors and gave the delegates every facility in the way of accepting mail and telegrams and furnishing messenger service.

H. B. COHO & COMPANY, 114 and 118 Liberty street, New York city, are distributing an attractive folder entitled: "What We Have Done, What We Are Doing, and What We Can Do for You." This gives numerous illustrations of installations which this company is responsible for as contracting engineers, and each particular installation is worthy of independent care and attention.

THE DOUBLEDAY-HILL ELECTRIC COMPANY, Pittsburg, Pa., will move on January 1 into its new eight-story building at 919 Liberty avenue. This is one of the finest buildings of the kind in the country. In its new quarters the company will have four times the space now occupied. The building will be used for the offices, storehouse, repair shops and factory, and will greatly add to the facilities for promptly taking care of orders of any magnitude.

THE ELECTRIC APPLIANCE COMPANY, Chicago, Ill., has on hand at its Chicago salesrooms, ready for immediate shipment, one of the largest stocks of weather-proof wires carried by any house west of the Allegheny Mountains. The company has published some very attractive literature regarding the Sprague Electric Company's flexible metallic conduit and is distributing a unique card advertising Grier's book of wiring tables and other valuable information.

THE MECHANICAL BOILER CLEANER COMPANY, Chicago, Ill., has just received from the Cudahy Packing Company an order for seven cleaners, this making sixty-five cleaners installed in the plants of that company. The Fort Wayne Gas Company has also made a duplicate order for thirteen cleaners. The Mechanical Boiler Cleaner Company owns all the Garrigus patents and is doing a very large business with many of the best corporations in the country. The device is claimed to keep boilers perfectly clean and remove all impurities from the water.

THE NEW BRITAIN MACHINE COMPANY, New Britain, Ct., is the manufacturer of the "Case" automatic high-speed engine. There are many novel features connected with this engine, which is built especially for small powers ranging from two and one-half to twenty-five horse-power. The engine is made in three main varities, *viz.*, the pedestal engine, which may be bolted to a substantial floor or a foundation; the bracket engine, which may be fastened directly on the wall where floor space is difficult to obtain; and the hanger engine, to be bolted to an overhead beam. The company also manufactures machinery for special kinds of work, such as driving fans and exciters, hoisting elevators, etc.

THE CLEVELAND CLIFFS IRON COMPANY is about to install an electric power distribution system for operating mixers and blowers in its Gladstone, Mich., plant, and has recently purchased from the Westinghouse Electric and Manufacturing Company two 75-kilowatt, direct-current generators and eight 10-horse-power, direct-current motors. The Pioneer Iron Works, of Marquette, Mich., owned by the Cleveland Cliffs Iron Company, will also be equipped with electrical apparatus, and has purchased from the same company an equipment of 10-horse-power, direct-current motors and two 150-kilowatt, engine-type generators, to be direct-coupled to compound condensing engines. The company has also ordered a Baldwin-Westinghouse electric locomotive, to be used for shifting cars in its yards.

THE SHELBY ELECTRIC COMPANY, Shelby, Ohio, has recently placed on the market a remarkably simple and compact enclosed arc lamp. This is suitable for both direct and alternating-current circuits. Two valuable patents have been granted on this lamp covering the balanced swinging cover and special magnetic coil, which will not burn out by reason of short-circuit in any part of the lamp. The characteristics for which special prominence is claimed for this lamp are the absence of springs or sliding contacts and the automatic alignment of carbons. The lamp may also be readily adjusted to take any desired amount of current, the operating temperature being very low. Another feature is that the lamp may remain on a dead short-circuit without injury to the magnetic coil. These lamps are made in either standard or miniature sizes and as each has been subjected to a very rigid test the company feels satisfied that it can assure its patrons of the entire desirability and practicability of the apparatus.